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[54] **GRAPHICAL USER INTERFACE  
SUPPORTING METHOD AND SYSTEM FOR  
REMOTE ORDER GENERATION OF  
FURNITURE PRODUCTS**

5,515,524 5/1996 Lynch et al. .... 395/500

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[51] **Int. Cl.<sup>7</sup>** ..... G06F 17/60

[52] **U.S. Cl.** ..... 705/26; 395/500.01; 705/27

[58] **Field of Search** ..... 705/1, 7, 8, 26,  
705/27, 400; 706/46; 346/326, 339, 433,  
418; 364/488, 512; 395/500, 500.01

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[57] **ABSTRACT**

A graphical user interface to a method and system for configuring office furniture includes interface objects for obtaining configuration criteria from a user; presenting the user with at least one typical configuration satisfying the criteria; selecting a typical configuration from the at least one typical configuration; modifying aspects of the selected typical configuration to produce a modified configuration; and checking the validity of the modified configuration. The configuration criteria include conferencing criteria; privacy criteria; power criteria; communications criteria; storage criteria; and area criteria. A typical can be modified by adding, deleting, or repositioning a component, changing the fabric or finish or the shape or size of the component. A cluster configuration based on the typical configuration is formed. The entire product line can be changed. At any time the entire typical or cluster configuration can be checked for validity and priced.

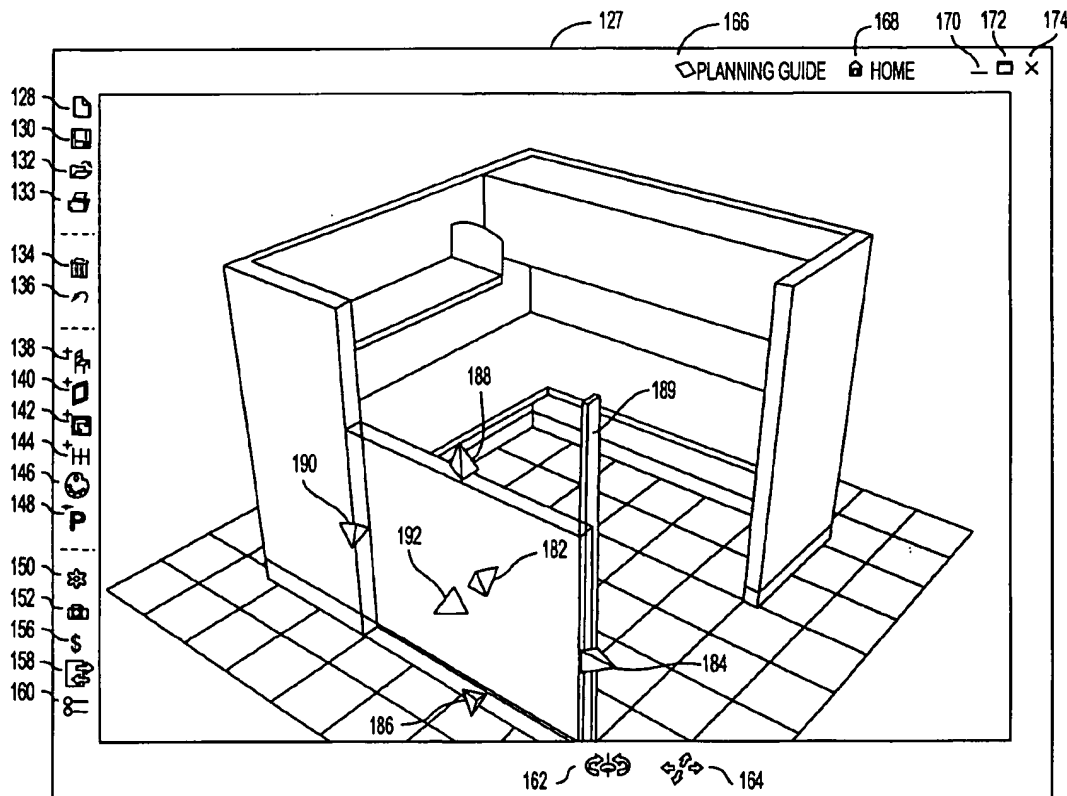
**41 Claims, 15 Drawing Sheets**

FIG. 1

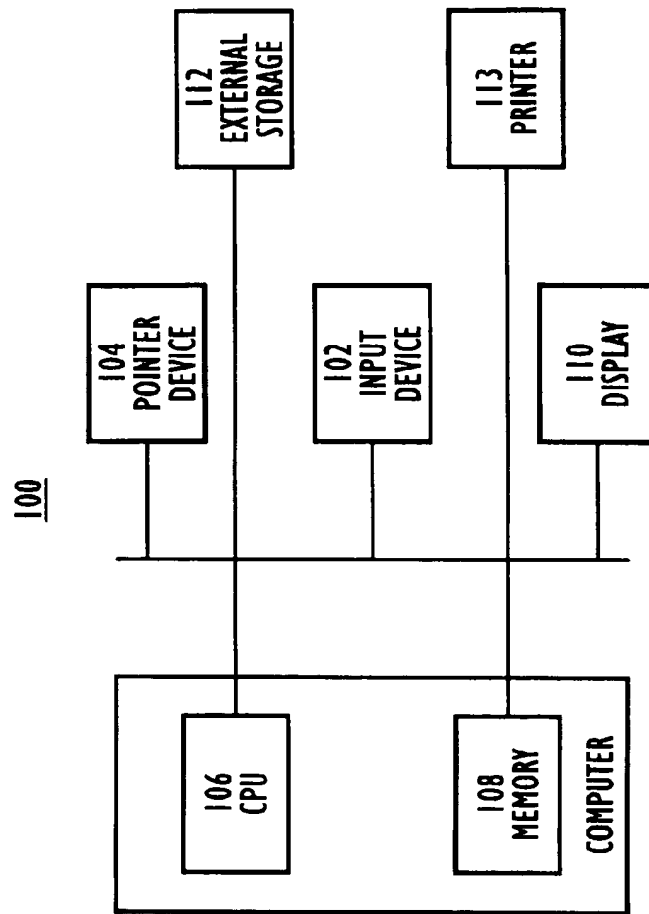


FIG. 2

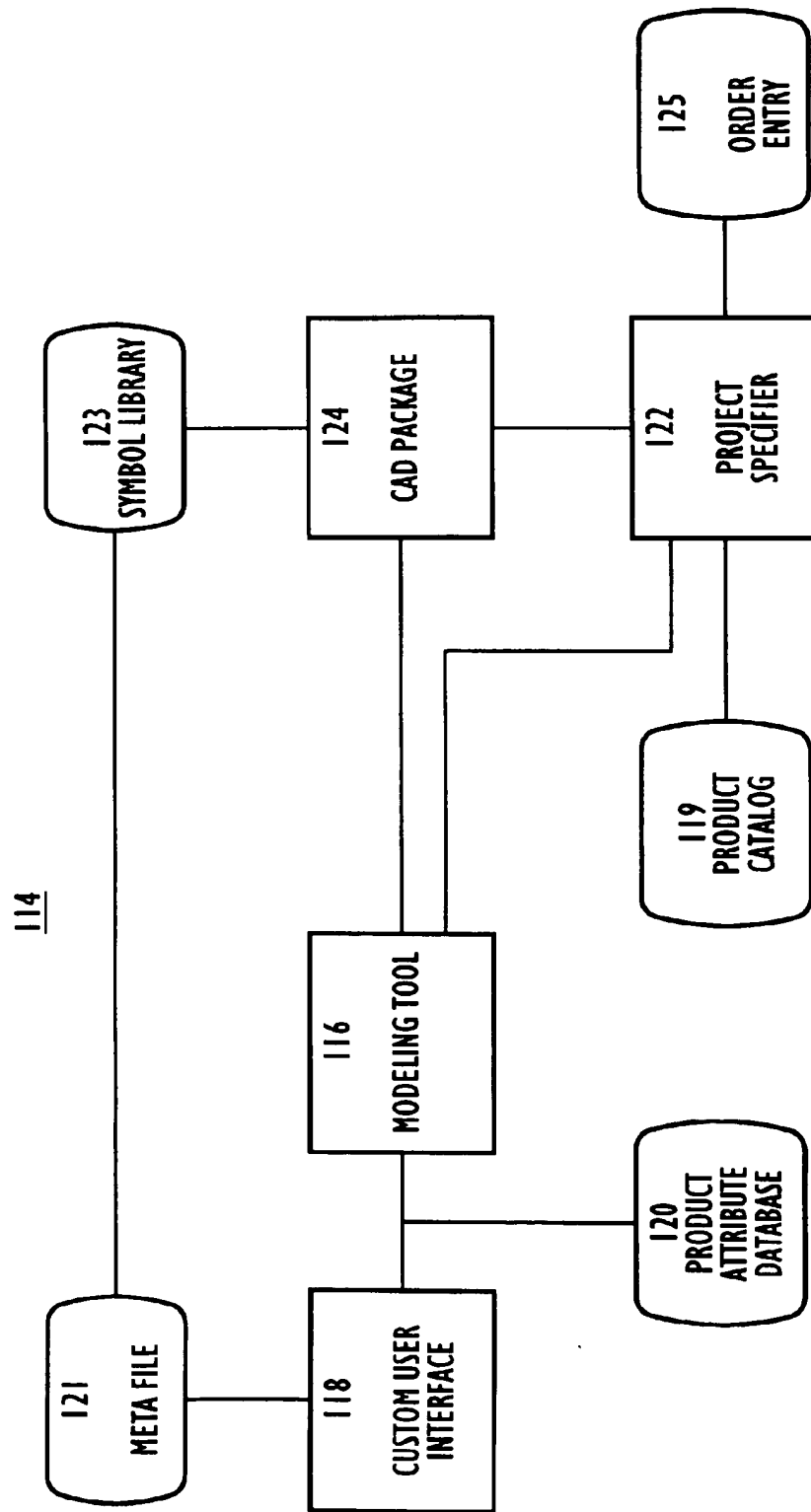


FIG. 3

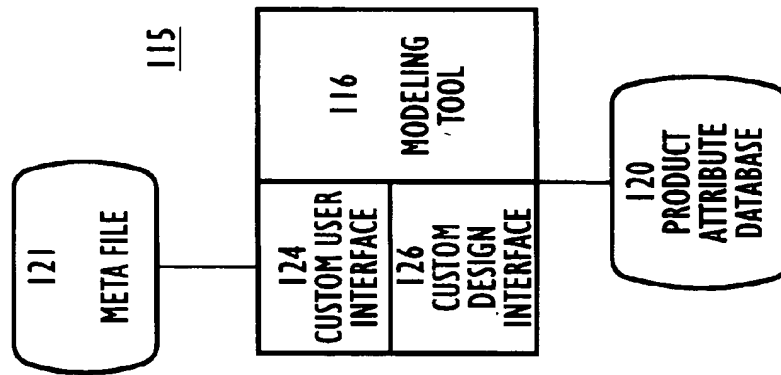
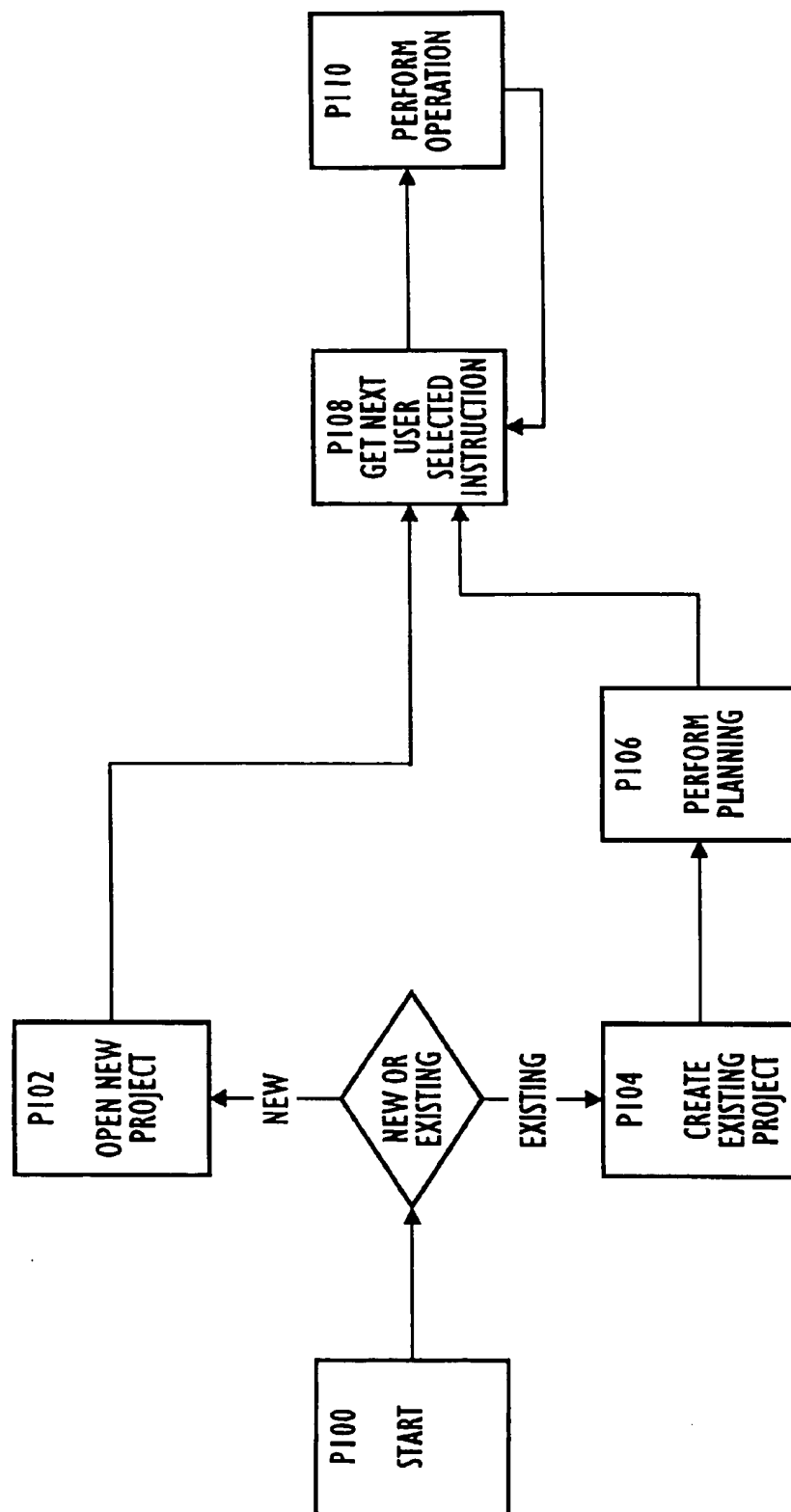
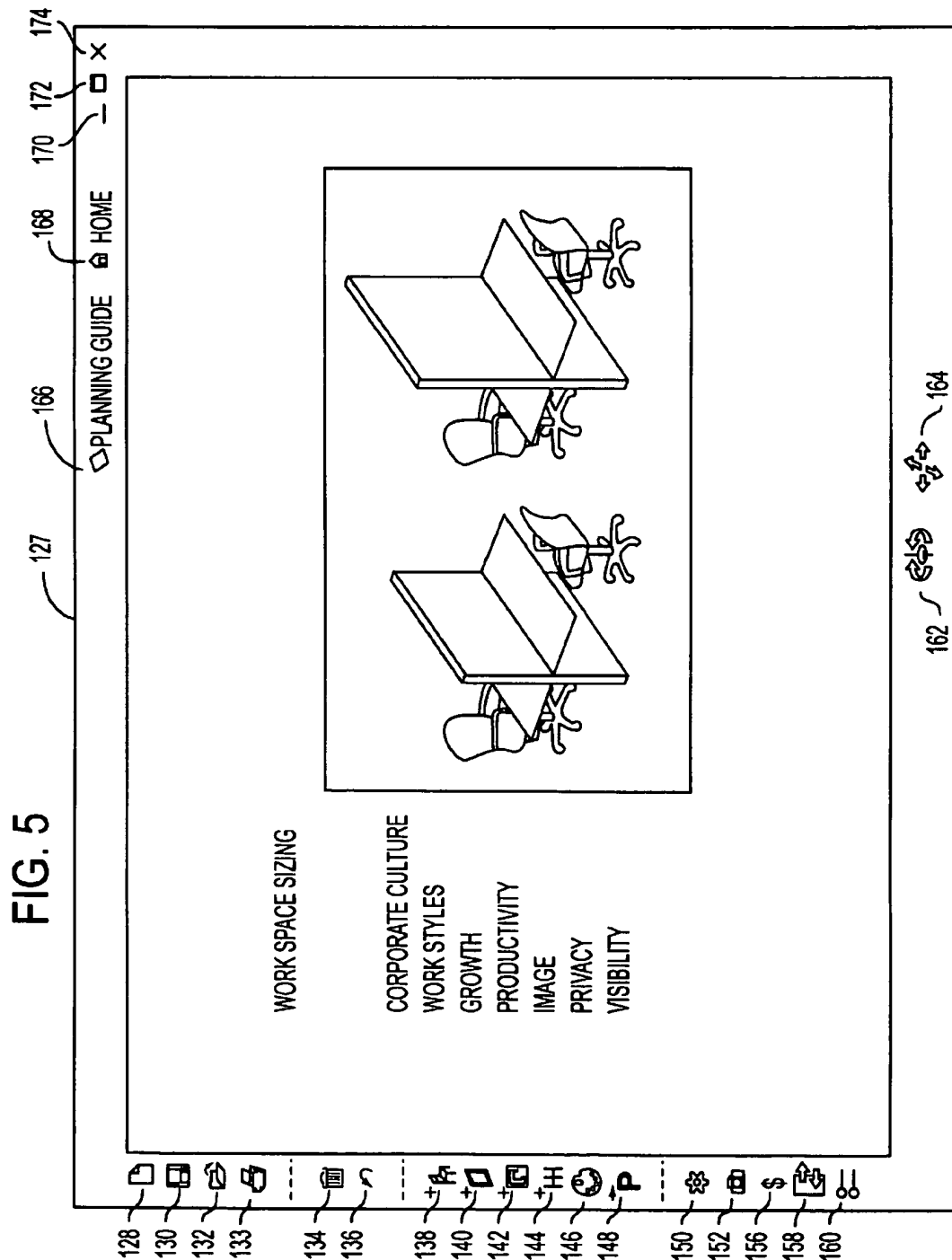
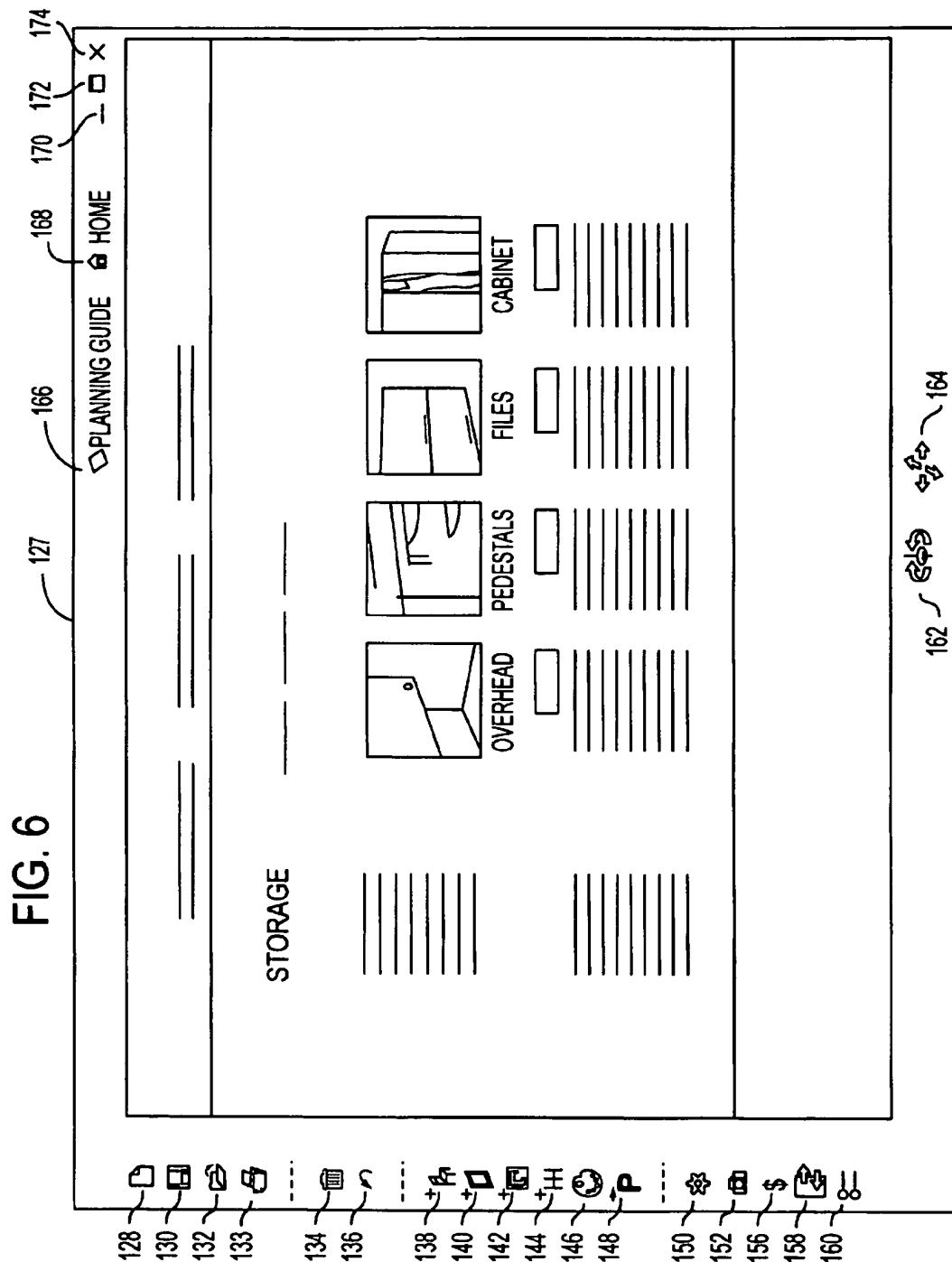
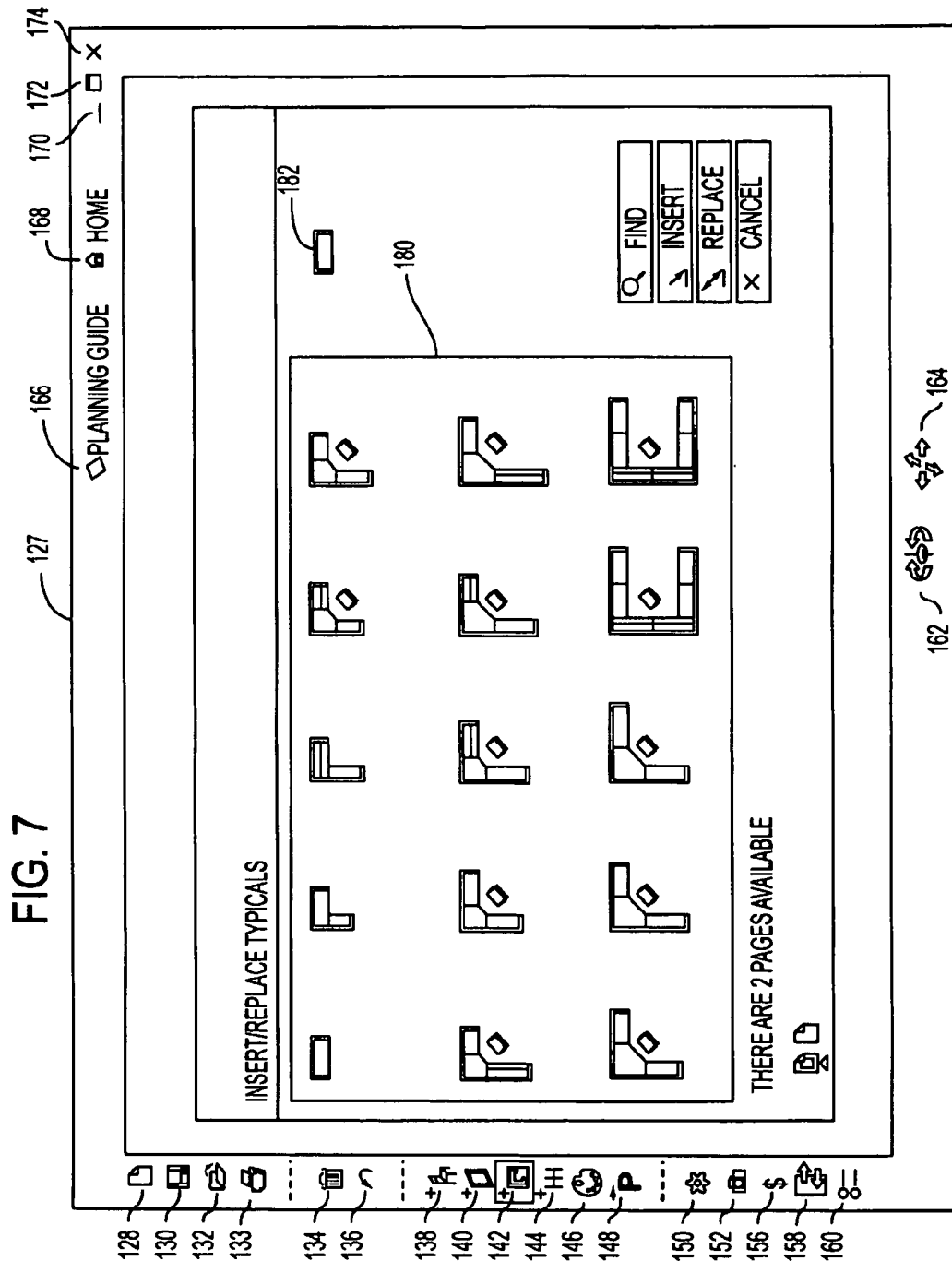


FIG. 4

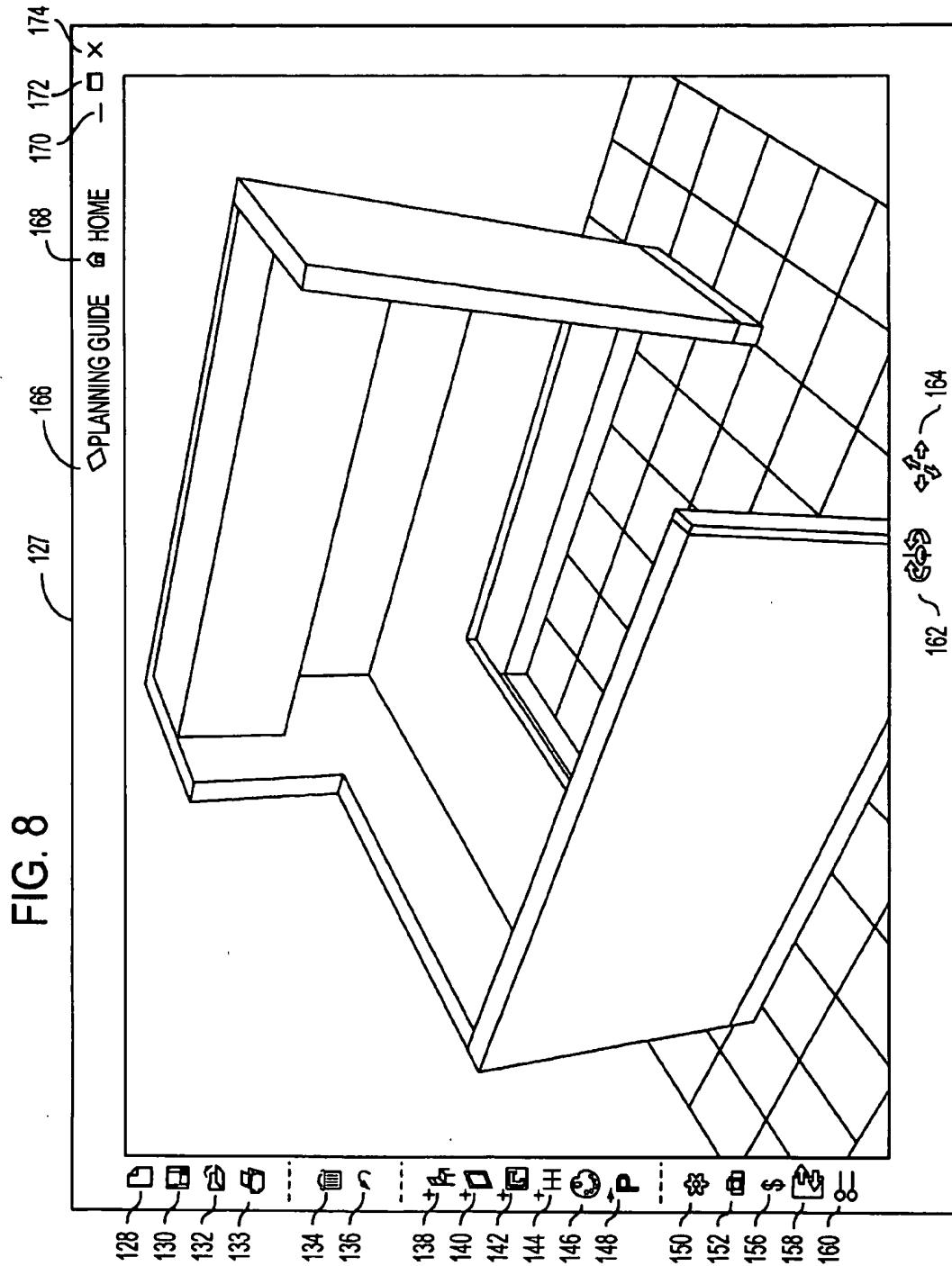


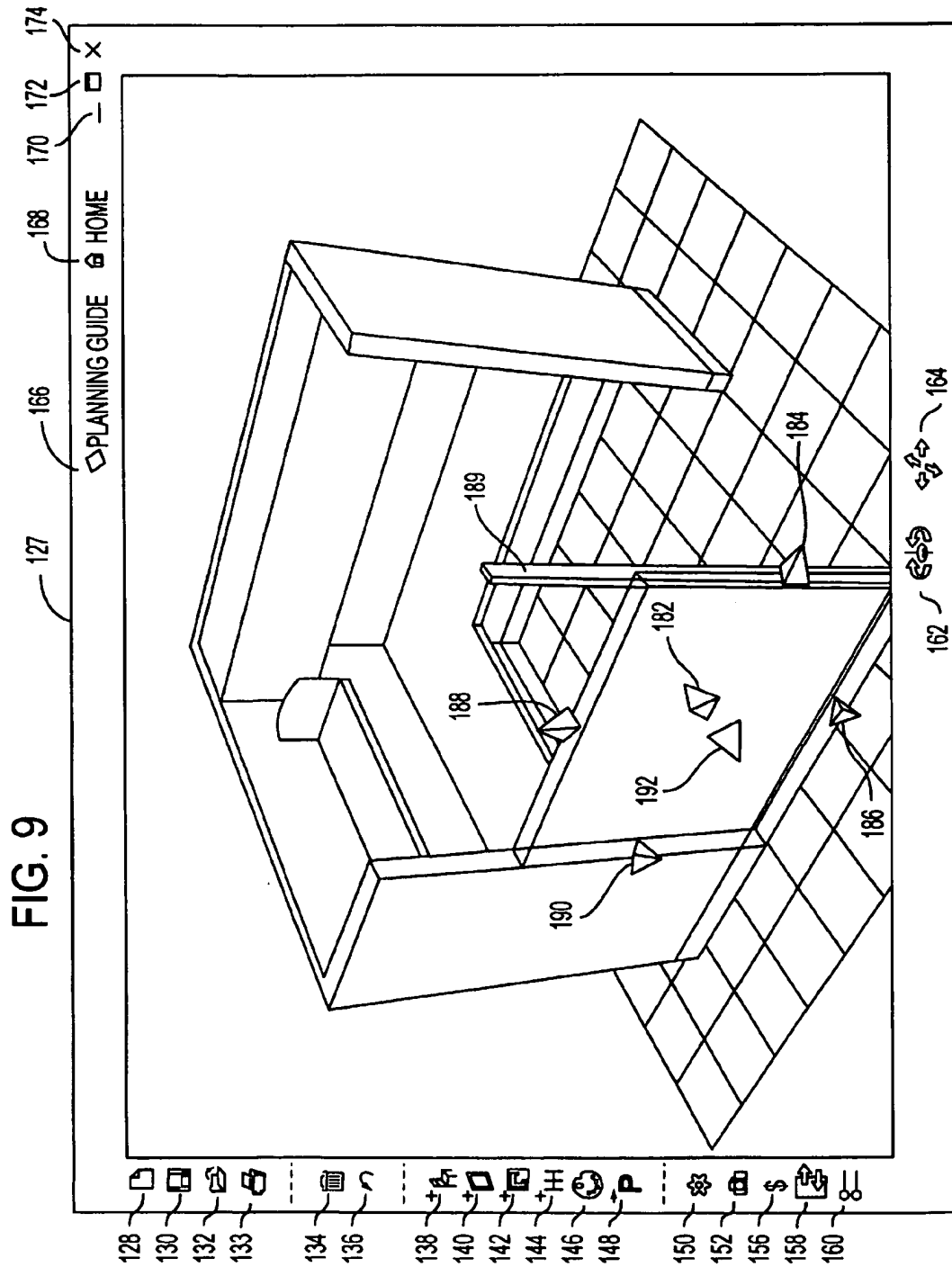


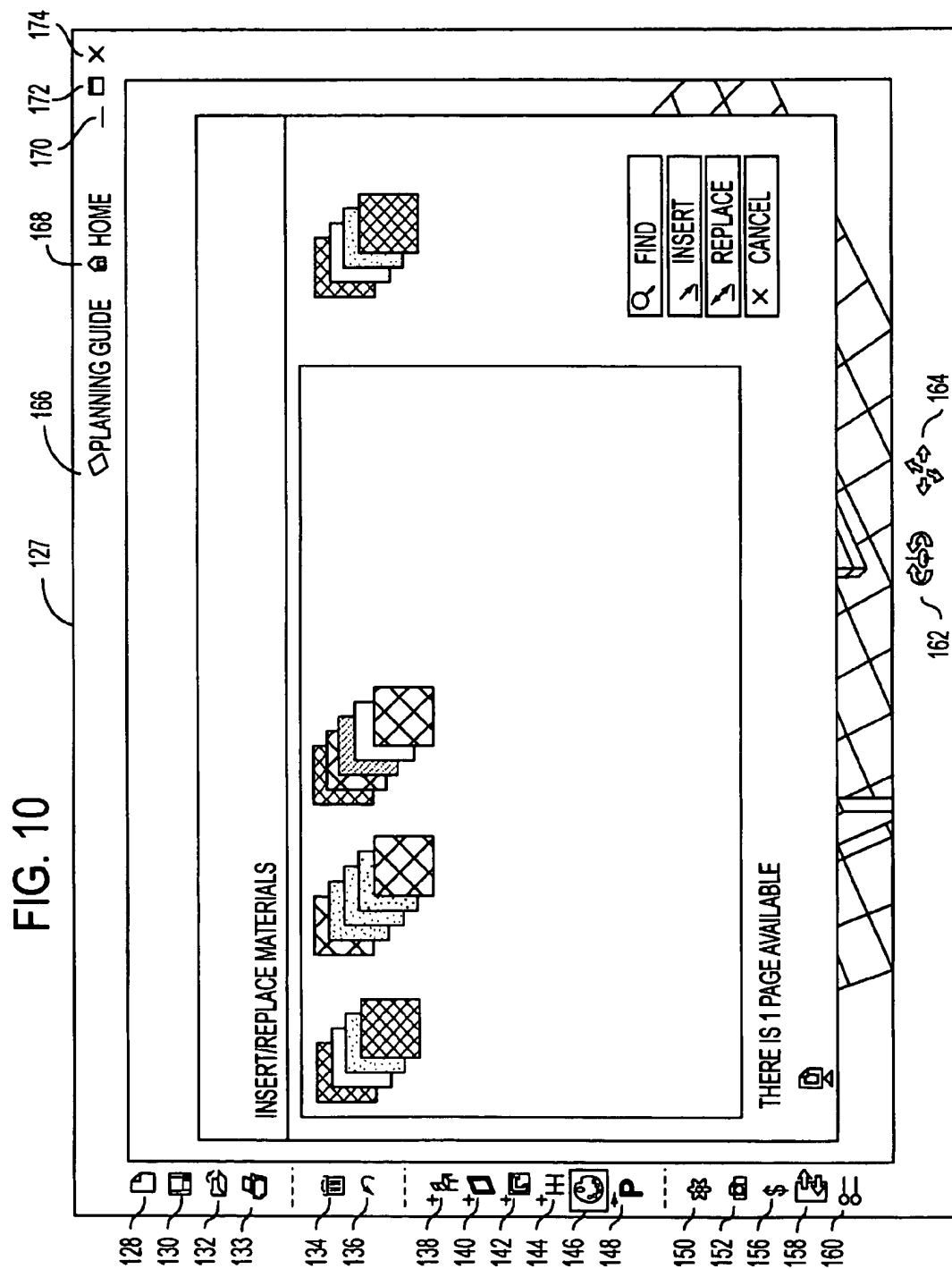


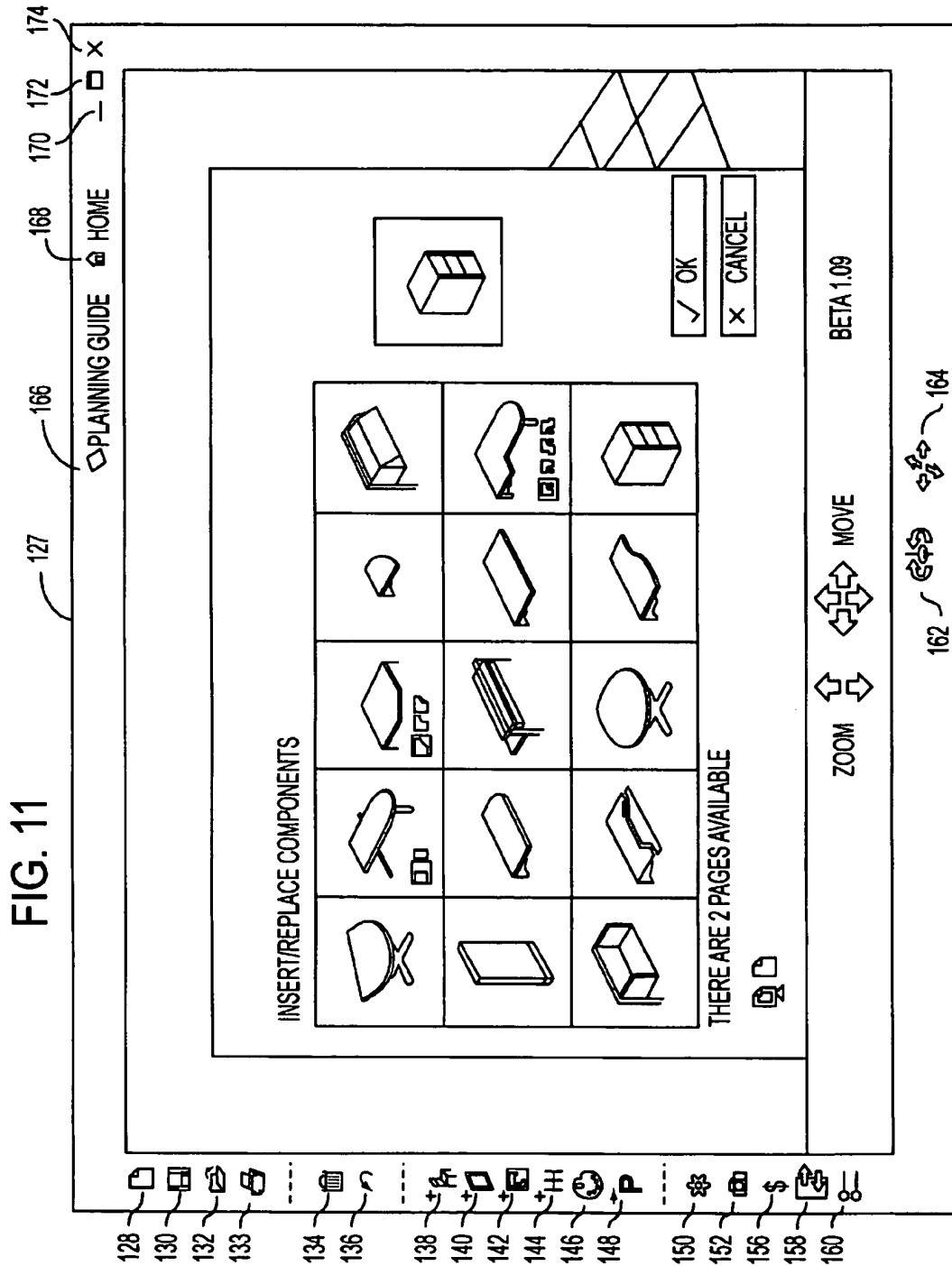


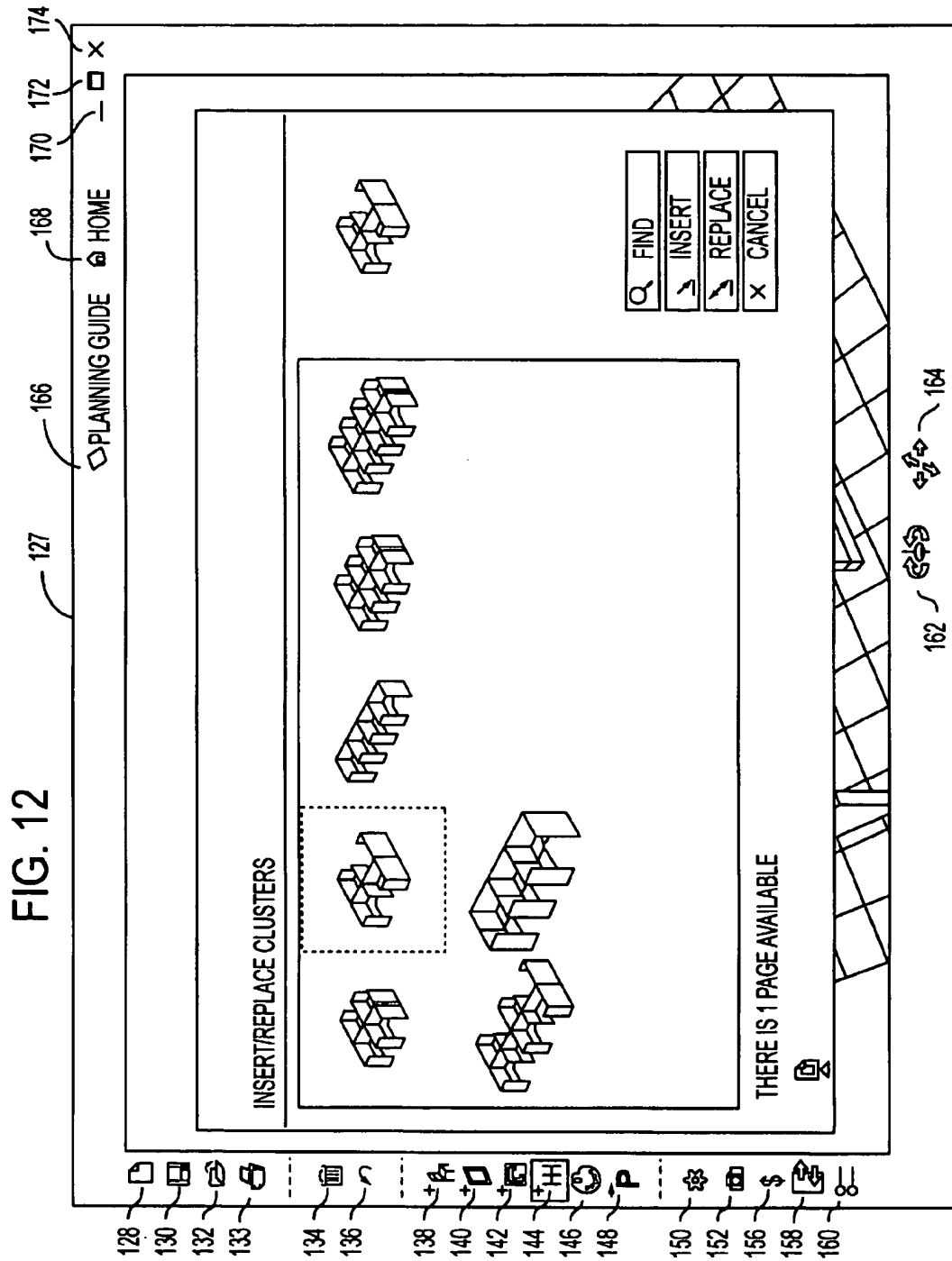


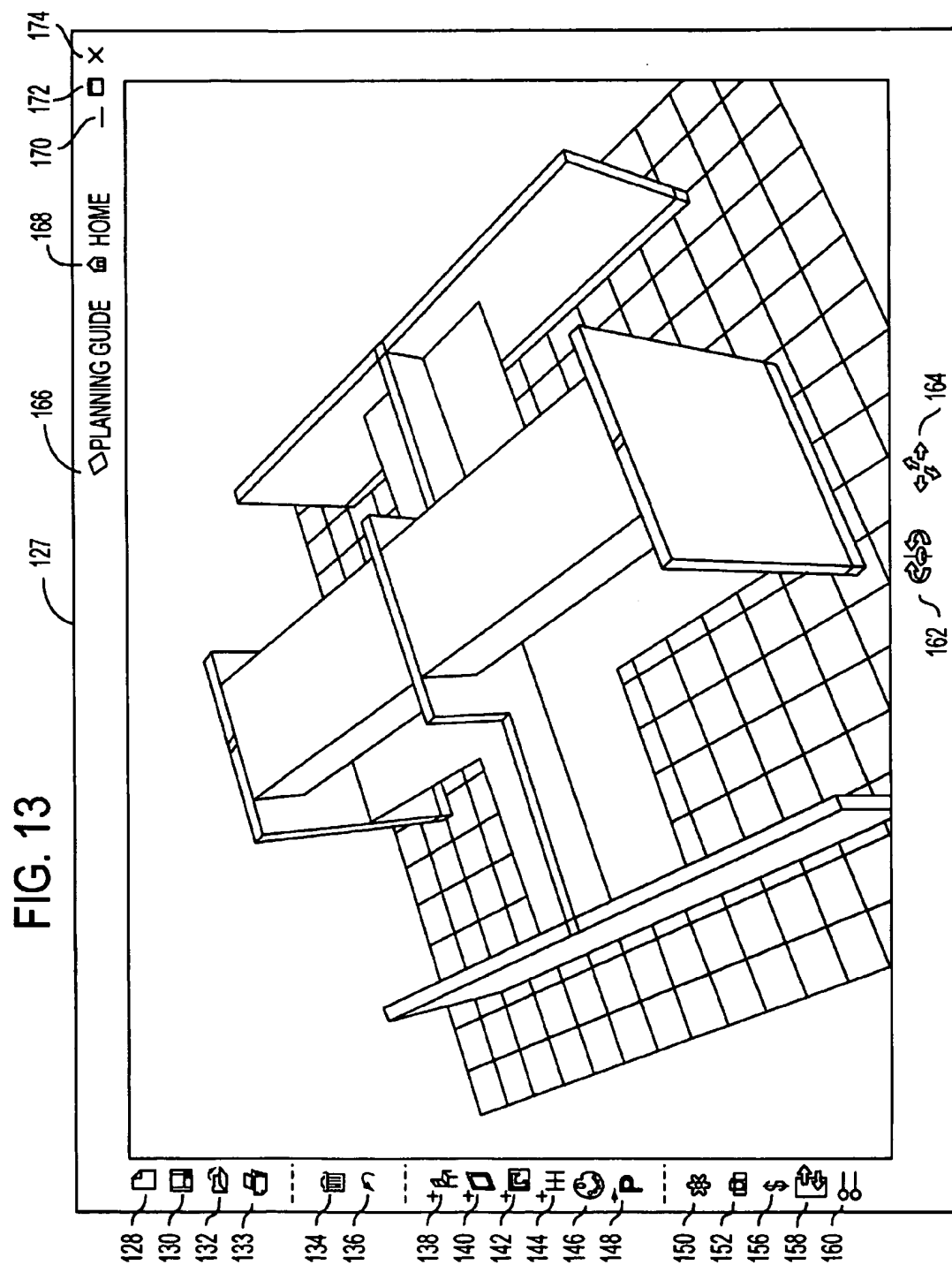












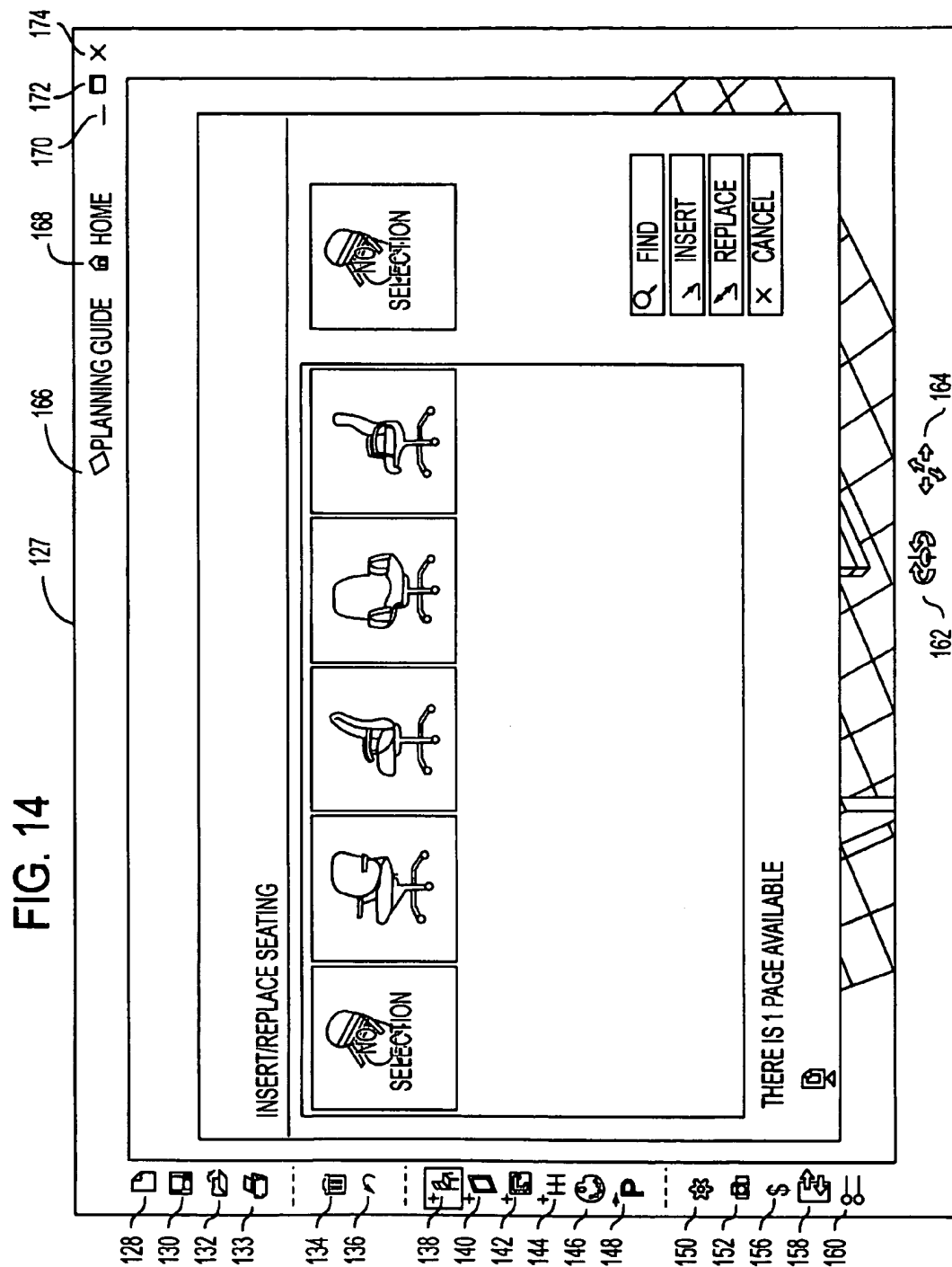


FIG. 15

128 130 132 133 134 136 138 140 142 144 146 148 150 152 156 158 160

127 166 168 170 172 174

PLANNING GUIDE HOME X

QUOTE BILL OF MATERIALS

COMPONENT	SIZE	QTY	BASE PART NU...	LIST	DISC.	EXT. \$	DEALER%	COST	MARGIN\$	MARG%
CURRENT PROJECT										
<input checked="" type="checkbox"/> PANEL	64x24	3	NPFW-6424-PF...	\$508.00	0%	\$1524.00	40%	\$609.60	\$914.40	250%
<input checked="" type="checkbox"/> PANEL	64x36	2	NPFW-6436-PF...	\$611.00	0%	\$1222.00	40%	\$488.80	\$733.20	250%
<input checked="" type="checkbox"/> PANEL	64x48	2	NPFW-6448-PF...	\$702.00	0%	\$1404.00	40%	\$561.60	\$842.40	250%
<input checked="" type="checkbox"/> FJOAH										
<input checked="" type="checkbox"/> FE-0C7										
<input checked="" type="checkbox"/> TR-00E										
<input checked="" type="checkbox"/> VP-00N										
<input checked="" type="checkbox"/> BRACKET	0	4	NSC-1,TR-00K	\$37.00	0%	\$148.00	40%	\$59.20	\$88.80	250%
<input checked="" type="checkbox"/> BRACKET	0	2	NUDS-15,TR-00R	\$37.00	0%	\$74.00	40%	\$29.60	\$44.40	250%
<input checked="" type="checkbox"/> BRACKET	0	1	NUSS-10,TR-00R	\$37.00	0%	\$37.00	40%	\$14.80	\$22.20	250%
<input checked="" type="checkbox"/> CONNECTOR	64	3	NV2W-64-F,TR-	\$161.00	0%	\$483.00	40%	\$193.20	\$289.80	250%
<input checked="" type="checkbox"/> COVER	64	2	NVEW-64-F,TR-	\$82.00	0%	\$164.00	40%	\$65.60	\$98.40	250%
<input checked="" type="checkbox"/> CONNECTOR	64	3	NVSS-64	\$35.00	0%	\$105.00	40%	\$42.00	\$63.00	250%
<input checked="" type="checkbox"/> WORK SURFACE	24x48	1	NWRW-2448,VP...	\$452.00	0%	\$452.00	40%	\$180.80	\$271.20	250%
<input checked="" type="checkbox"/> VP-00N										
<input checked="" type="checkbox"/> WORK SURFACE	24x72	1	NWRW-2472,VP	\$576.00	0%	\$576.00	40%	\$230.40	\$345.60	250%

OVERALL DISCOUNT: ☒ PERCENTAGE ☐ TIERED

2 %

☒ VIEW ENHANCED ANALYSIS 0.000000

TOTALS  
DEALER COST \$2,475.60  
DEALER MARGIN \$2,475.60  
QUOTE TOTAL \$0.00

% DISCOUNT % DISCOUNT % DISCOUNT  
HEADER OK X CANCEL

162 164



# GRAPHICAL USER INTERFACE SUPPORTING METHOD AND SYSTEM FOR REMOTE ORDER GENERATION OF FURNITURE PRODUCTS

## BACKGROUND OF THE INVENTION

### 1. Reservation of Copyright

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### 2. Field of Invention

This invention relates to graphical user interface supporting a method and system for enabling the selection and configuration of complex furniture products. More specifically, this invention relates to enabling the selection and configuration of three-dimensional office furnishing products so as to enable remote order generation of valid and acceptable configurations of those products.

### 3. Description of Background Information

The sale process for complex products, that is, products that are made up of many interconnected parts, is notoriously difficult, especially when customers are given configuration and product-line choices.

For example, in the office furniture industry, the goal of the sale process is to provide the customer with an acceptable furniture configuration within the customer's price limitations.

From the customer's perspective, an acceptable configuration is one which will provide workspace for their employees within various work-related and space criteria set by the customer. For example, a customer may need to provide, in a given area, sitting work space for a thousand people, where all people have acoustic privacy. A customer's criteria may be complex and often the customer does not really know what they are, other than to know the number of people and the space they will go into.

From the manufacturer's perspective, an acceptable configuration is one which can be manufactured from the manufacturer's product line. That is, an acceptable configuration is a valid, manufacturable configuration of existing component parts.

The sales process is essentially an attempt to reach a convergence on a configuration which is acceptable to the customer (meets all space, price and other requirements) and which is acceptable to the manufacturer (is a valid configuration which is manufacturable).

An office workspace configuration may comprise thousands of parts drawn from an inventory of millions of possible parts. Each workspace may comprise dividing walls or side panels, work surfaces, storage areas, support structure, electrical structure and the like. Even for a given configuration of workspace, there are various qualitative and quantitative options available. Each part may be available in various qualities and in various colors. Some of the parts may not be compatible with parts from other product lines of the same or other manufacturers. Further, any choice made, even for a single part, may affect the entire configuration.

A customer wishing to buy a complex product such as office furniture is faced with an incredible number of interdependent choices.

In the office furniture market at present, a typical sale takes place as follows: A salesperson visits a customer and

presents the customer with drawings of some typical configurations of various product lines. The customer selects various options which the salesperson records. At this time all of the sale is taking place in terms of individual parts and not in terms of the final product or even in terms of compound components of the final product. In other words, the customer does not buy a collection of workstations, instead he buys a collection of parts.

Once the customer is satisfied with the configuration, the salesperson goes back to the manufacturer who determines whether or not the configuration is actually possible given the current product line. For example, the customer may have put a shelf on a dividing panel without confirming that the panel could actually support such a shelf. Or a panel may be given a size which the manufacturer does not or cannot manufacture. Accordingly, the manufacturer then tries to build the customer's proposed order using a CAD (computer aided design) system and a collection of known parts. Errors in the customer's proposed order are reported and, in some cases, a best attempt at the order is drawn up. From this best attempt produced by the CAD operators, a list of required component parts is obtained and then a price for the entire configuration is determined for all of the component parts.

This process, so far, can take more than two weeks. The sales person then goes back to the customer with the design, as best it could be done, and the price for this design. This is the first time that the customer sees his actual order drawn out, and usually in two-dimensions. If there were errors in the design, which there usually are, or if the customer does not like the current design, the process is repeated.

After some number of iterations (that is customer to sales person to CAD operator to pricing and back to the customer via the sales person), the customer is finally presented with an acceptable configuration and a price for that configuration.

In a typical sales scenario this whole order process (i.e., convergence to a configuration which is acceptable to both the customer and the manufacturer) takes six sales calls and design iterations.

Even when the customer is satisfied with a configuration and even if it is a valid, manufacturable configuration, there is no simple way for anyone to go back and ask a simple "what if" type of question about the order. For instance, if, in an order for an acceptable configuration, the customer wants to know the effect on price of changing to a different quality panel system, the whole price would have to be redetermined by the manufacturer.

To see why this pricing and configuration process is not simple, consider the change from a high quality panel to a lower quality panel of the otherwise same dimensions. Suppose that the panel has a shelf hanging on it and that the high quality panel can support shelves whereas the lower quality panel cannot support shelves without an extra support. So, a supposedly simple question like "What if I use this type of panel instead of that?" can lead to an entire reconfiguration and repricing of the system. Its often not enough to just change the price of the components being used, sometimes the components themselves have to be supplemented. In some cases, changes may not be possible.

Even from a salesperson's perspective, the inability to price "what if" scenarios has major drawbacks. For instance, if a customer is satisfied with a configuration's layout but still thinks that the price is too high, it is desirable for the salesperson to be able to make qualitative changes to the configuration and show what the corresponding price changes would be. In the case of office furnishings, a

salesperson would like to be able to show, at the customer's site and at the time of setting up the configuration, the effects on price of various changes. In that way, convergence to an acceptable configuration can be achieved with greater speed.

In the general field of product configuration, tools have been developed to aid in selection and validation of configurations. One such system is available from Trilogy Development Group of Austin, Tex., and is described in U.S. Pat. No. 5,515,524, "Method and Apparatus for Configuring Systems," to Lynch et al, which is expressly incorporated herein by reference in its entirety.

Lynch describes a constraint based configuration system using a structural model hierarchy. The structural aspects of the model provide the system with the ability to define a model element as being contained in, or by, another model element. The structural model provides the ability to identify logical datatype and physical interconnections between elements and to establish connections between elements.

In order to configure a product, Lynch's system accepts input in the form of requests or needs. Using this information, Lynch's system configures a system by identifying the resource and component needs, constraints imposed on or by the resources or components identified, and the structural aspects of the system.

In the specific area of office furniture configuration, attempts have been made to provide customers with simple CAD systems with which to design their configurations. The problems with these systems include that they are difficult to use, they are inaccurate, they do not provide the customer with a way to determine whether or not he has a valid, manufacturable configuration (so the customer still has to go back to the manufacturer to have configurations manually checked), and they do not have any knowledge of the manufacturer's product line. Further, no proposed systems are able to prepare a configuration and provide a price for that configuration.

#### SUMMARY OF THE INVENTION

It is an object of this invention to provide an order generation system, preferably a remote order generation system.

It is a further object of this invention to provide sales people and customers with product configuration systems that are easy to use, accurate, provide the customer with some way to determine whether or not he has a valid, manufacturable configuration (so that the customer does not have to go back to the manufacturer to have configurations checked each time they change), and that has knowledge of the manufacturer's product line. It is a further object of this invention to provide a system that is able to prepare a configuration and that is also able to provide a price for that configuration.

It is also an object of this invention to provide a system that can have product line and price information added and modified.

It is also an object of this invention to provide a system that generates visual specification in two-dimensional (2-D) and three-dimensional (3-D) rendered images.

Accordingly, in one aspect, this invention provides a graphical user interface to a computer program for configuring and ordering office furniture. The user interface presents a user with various selectable options, via display screens on a monitor. Depending upon which options the user selects, the graphical user interface provides the user with information about the product selected or gets input from the user about his requirements.

The user can interact with the order generation program via the user interface to select a basic configuration of furniture, modify the configuration, create a cluster derived from the basic configuration. At all times the user is able to ensure that the current configuration is valid (i.e., manufacturable and/or within the product line) and the user is able to obtain price information about the configuration.

The system takes as input user criteria such as conferencing criteria; privacy criteria; power criteria; communications criteria; storage criteria; and area criteria.

The user, via the user interface, can modify a configuration by adding, deleting or moving components in the configuration or by changing the size or shape of a component of the configuration. When the shape or size of a component is adjusted, it can only be changed to a valid shape or size, thereby maintaining the integrity of the displayed furniture configuration.

Generally, at any stage of the furniture configuration, the user is able to obtain a realistic display of the configuration and is then able to view that display from arbitrary view points.

Thus, in one aspect, this invention is a graphical user interface, a method for using the graphical user interface, or a method of configuring office furniture. In another aspect, this invention is computer-readable media tangibly embodying an interface program of instructions executable by the machine to provide a graphical user interface to a computer program for configuring office furniture.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features, and advantages of the present invention are further described in the detailed description which follows, with reference to the drawings by way of non-limiting exemplary embodiments of the present invention, wherein like reference numerals represent similar parts of the present invention throughout the several views and wherein:

FIG. 1 depicts a typical computer system on which the order generator of this invention operates;

FIG. 2 shows the architecture of a preferred embodiment of the order generator according to this invention;

FIG. 3 shows the architecture of an alternative preferred embodiment of the order generator according to this invention;

FIG. 4 is a flowchart of the operation, from a user's perspective, of the order generator of the present invention; and

FIGS. 5-15 depict various interface displays of the order generator of the present invention during its operation.

#### DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EXEMPLARY EMBODIMENTS

This invention operates on a typical computer system 100 such as shown in FIG. 1. The computer system 100 includes various input devices 102 such as a keyboard, as well as a pointer device 104. A mouse, track ball, touch screen, keyboard cursor control keys or the like can be employed as the pointer device 104. The computer system 100 also includes a processor such as CPU 106 and internal memory 108. The processor 106 may be a special purpose processor with image processing capabilities or it may be a general purpose processor. The memory 108 may comprise various types of memory, including RAM, ROM, and the like. The computer system 100 also includes external storage 112

which includes devices such as disks, CD ROMs, ASICs, external RAM, external ROM and the like.

The present invention can be implemented as part of the processor 106 or as a program residing in memory 108 (and external storage 112) and running on processor 106, or as a combination of program and specialized hardware. When in memory 108 and/or external storage 112, the program can be in a RAM, a ROM, an internal or external disk, a CD ROM, an ASIC or the like. In general, when implemented as a program or in part as a program, the program can be encoded on any computer-readable medium or combination of computer-readable media, including but not limited to a RAM, a ROM, a disk, an ASIC, a PROM and the like.

The computer system 100 also includes a display 110 and, optionally, an output device such as a printer 113.

The computer system 100 can run any operating system.

In preferred embodiments, the computer system 100 is an IBM PC compatible notebook computer configured with a Pentium 90 (or above) CPU (for processor 106) and, (for memory 108) a minimum of sixteen Mbytes RAM, a CD drive and a hard drive with 840 Mbytes, with approximately thirty Mbytes of free disk space (for external storage 112). The computer system 100 preferably runs Microsoft Windows 95 as its operating system.

The preferred display 110 is an 800x600 active color matrix display with sixteen-bit color. The preferred printer 112 is at least an ink jet color printer.

While the preferred computer system is a stand-alone system, in other embodiments the computer system 100 is connectable to a network of computers so that some or all of its processing functions, for example, for complex tasks, can be off loaded to other computers on the network. In network environments some or all of the data may reside at remote locations.

The architecture of a preferred embodiment of the order generator is shown in FIG. 2 wherein the order generator 114 uses a modelling tool 116 connected to a custom user interface 118. Both the modelling tool 116 and the custom user interface 118 access (read and/or write) various databases, including a product attribute database 120. The user interface 118 also accesses a meta file 121 which it uses to share data through a symbol library 123 with a CAD package 124.

The modelling tool 116 takes as input various user configuration specifications via the custom user interface 118, verifies their validity and determines their pricing. This information can be passed back to the custom user interface 118 or it can be used by a project specifier 122, in conjunction with the CAD package 124, to produce an actual order 125. The project specifier 122 also takes input from a product catalog 129 in order to produce the actual order 125.

In one aspect, the custom user interface 118 operates as a front-end to the modelling tool 116, providing it with user requirements, user specified furniture configurations and other information and obtaining from it configuration information including whether or not a configuration is valid and the price of the configuration.

Preferably the modelling tool 116 is one which uses a generative approach for configuring systems. Such a system is available from Trilogy Development Group of Austin, Tex., and is described in U.S. Pat. No. 5,515,524, "Method and Apparatus for Configuring Systems," to Lynch et al, already incorporated by reference herein in its entirety.

Lynch's system, in order to configure a product, accepts input in the form of requests or needs. Using this

information, Lynch's system configures a system by identifying the resource and component needs, constraints imposed on or by the resources or components identified, and the structural aspects of the system.

Thus, in the present invention, the modelling tool 116 is programmed to configure office furniture systems by identifying the component needs, resources, and constraints imposed on or by the resources or components identified, and the structural aspects of the system. For example, a particular storage requirement may require a certain type of panel. If a user requires that type of storage then the appropriate type of panel must be used.

The model can handle both configuration and checking functions. In the preferred embodiment, three-dimensional objects and their topological relationships are modelled. The attributes modeled include, but are not limited to:

- size (x, y, z dimensions);
- color;
- texture;
- finish (fabric/direction, wood/direction, laminate, glass, metal);
- obsolescence;
- power (electric); and
- weight.

The modelling system 116 can connect workstations, recognize and fix common walls, resolve component duplication and overlap, indicate obstacles and resolve power connectivity. For example, with regard to panel connectivity, angles are confined to a limited number of fixed positions. As to common walls, from a two-dimensional representation of a layout, the system ensures that the correct number of parts is calculated.

The modelling system 116 bases its determinations on the input user requirements and on information in the product attribute database. It also uses a model of the interrelationships between the various components. An example of such a model is shown in the tables appearing at the end of this specification.

In an alternate embodiment of the order generation system 115, as shown in FIG. 3, the functions of the project specifier are incorporated into the modelling tool 116 and there is tight coupling of the modelling tool to a CAD program. In this embodiment of the order generation system 115, there are two integrated interfaces to the modelling tool 116, namely a custom user interface 124 and a custom design interface 126.

#### System Operation

The operation of the order generation system 114, particularly the custom user interface 118, on computer system 100 is now described with reference to FIGS. 1-15. The custom user interface 124 of the alternative embodiment 115 shown in FIG. 3 operates in the same manner.

When the order generation system 114 begins running on computer system 100, the user is presented with a start screen on the display 110 of computer system 100 (at P100 in FIG. 4). The start screen presents the user with various user selectable options. The options are presented as demarcated text areas or as icons on the screen depicted on the display 110 of the computer system 100. Each presented option can be selected with the pointer device 104 or using one or more keys on the keyboard 102. An option is selected in a known manner such as by clicking the pointer device 104 on the area of the screen on which the option is displayed.

When an option is selected, the custom user interface 118, running on computer system 100, determines which option

has been selected and then either processes the option or effects processing of that option. For example, some options are processed entirely within the user interface 118 itself, whereas others require processing by other components of the system 114, in particular by the modelling tool 116.

Generally the custom user interface 118 keeps track of user information at a project level. For each project the custom user interface 118 gets information from the user and then tracks and stores that information as needed. The information is tracked and stored in a manner known in the art such as in a data structure or database which can be accessed as needed. When the user interface 118 requires information regarding product attributes, it obtains that information from the product attribute database 120. When, as the result of some implicit or explicit user request, the user interface 118 requires some processing to be performed by the modelling tool 116, the user interface 118 invokes the appropriate functionality of the modelling tool 116 and gives the modelling tool 116 whatever data is needed. For example, if, as will be described below, the user requests, via the user interface 118, that the modelling tool 116 check the validity of a furniture configuration, then the user interface 118 will pass to the modelling tool 116 the appropriate data representing the current configuration. Using the data it receives about the configuration from the user interface 118, along with whatever information it needs from the product attribute database 120, along with the model of the system, the modelling system will then, as requested, check the configuration of the configuration. The result of the configuration check by the modelling tool 116 is not simply a binary "valid" or "invalid" result, but, when possible, is a valid configuration. Thus, the modelling tool 116 is able to pass back configuration data to the user interface 118.

From the start screen presented to the user by the user interface 118, the user is given the option of either loading an existing project (i.e., a project which was previously saved by the order generation system 114) (at P102), or beginning a new project (at P104). If the user selects the option to open an existing project, then the order generation system 114, via the user interface 118, prompts the user for the name under which that project was saved. If the named project can be found, the order generation system 114 retrieves the project and loads it into the system, otherwise the user is prompted for another project name or to start a new project.

If the user selects the option to create a new project (at P104), then the user is prompted (at P106) to input the needs of the project on a series of planning guide screens. Based on the user's input into the planning guide screens, the order generation system 114 determines which options to present to the user in subsequent display screens.

For example, the user interface 118 compiles or translates the entered user requirements into criteria which both it and the modelling tool 116 can use. Then, when requesting a list of components which meet the user's needs, the user interface and, when necessary, the modelling tool 116, can query the requirements to ensure that they are met.

One example of such a use would be if the user's needs included standing privacy and lockable storage space. Then, as described below, when the user requested a list of typical configurations satisfying his needs, those which did not provide standing privacy and lockable storage would be excluded.

The various planning requirements (user needs) for which the user is prompted include, but are not limited to, privacy requirements, storage requirements, conferencing criteria, electrical/computer space and connection requirements,

space requirements, budget constraints, lighting requirements and types of use.

As to privacy options, the user is given the option of specifying the privacy requirements in terms of panel heights or in terms of various types of privacy: "seating privacy", "standing privacy", "acoustic privacy" and the like. If the user selects certain types of privacy, the order generation system 114 translates this selection into a panel height selection. In preferred embodiments the user is presented with images such as shown in FIG. 5 in order to explain the various privacy options.

Preferably the planning guide consists of a series of forms which are graphically displayed on the screen, each form having a number of options. Once the user selects a particular option, a screen for that option is displayed with questions about the various sub-options. For example, in order to determine the user's storage requirements, the user selects a storage requirements option and is presented with a storage requirements screen. As shown in FIG. 6, this screen includes pictures of various types of storage along with textual descriptions of the items which can be stored in each kind of storage.

In some embodiments the user is also provided with an optional tour through a virtual showroom. This tour would consist of a multimedia (e.g., Quicktime etc.) tour through a showroom demonstrating the various product lines available and various configurations of those products.

Once the user has completed the planning (at P106) or opens an existing project (at P102) the order generation system 114 provides the user with various options described below. In general, navigation in the order generation system 114 is non-modal. That is, any display screen can be reached from any other display screen and user selected instructions or operations (at P108) are performed (at P110), in effect, either by the user interface 118 or by some other part of the order generation system 114 such as the modelling tool 116. Generally, when a user selects an instruction, the order generation system 114 running on computer system 100 performs that instruction. Preferably the user interface 118 performs as many functions as it can, passing requests to the modelling tool 116 only as needed.

Thus, as shown in FIG. 7, each display screen 127 includes various user selectable icons (128-174). Preferably, the icons (128-174) are grouped and positioned on the screen 124 according to their type of functionality. For example, icons 128-133 relate to project maintenance (saving and restoring) and printing functions; icons 134 and 136 relate to editing functions; icons 138-160 relate to configuration and customization functions; icons 162 and 164 relate to image positioning and moving functions; planning guide icon 166 relates to the planning guide functionality (described above) and the home icon 168 returns the user to the start (or home) display screen. The window control icons 170-174 are used to size and position the display screen 126 on the display 110.

When the user selects (by clicking on it with the pointer device 104) the new project icon 128, then the user is prompted for the name of the new project and a new project is created.

When the user selects the save project icon 130, the order generation system 114 saves the current project to a storage device connected to the computer system 100. The user has the option of changing the name of the project when it is saved.

When the user selects the open project icon 132, the user is prompted for the name of the project to be opened. If the project of that name is found then it is opened and replaces the current project in the order generation system 114.

When the user selects the print icon 133, then the user interface 118 prints the current project.

When the user selects the delete icon 134, then order generation system 114 deletes the current selection (on the display). The undo icon 136 is used to undo previous deletions.

The configuration icons 138-148 are now described in greater detail.

By selecting the new typical icon 142, the user is able to select a typical workstation configuration which satisfies the user's requirements input in the planning stage (at P106).

When the user selects the new typical icon 142 a graphical depiction of various typical workstation configurations 180 is displayed on the screen. Each of these displayed typical configurations should satisfy some of the user's requirements, at least with regard to privacy, work area and electrical connectivity. Price and space requirements cannot always be satisfied until a complete clustered configuration is determined.

The user can select one of the displayed typical workstation configurations by clicking on it with the pointer device 104. The selected typical configuration is highlighted and displayed on the screen (at 182).

The system is pre-configured with a number of so-called typical configurations, and preferably the typical configurations displayed on the typical screen are those which satisfy the customer's criteria entered at the customer needs screen (reached by selecting the planning guide icon 166).

Once the user has selected the typical configuration that is to be used, the user can then double click with the pointer device 104 on the depiction of that typical in order to view it and operate on it. At that time the order generation system 114 displays a three-dimensional view of the selected typical on the screen on display 110 (FIG. 8). Preferably the selected typical furniture configuration is displayed with the appropriate colors and textures.

With reference to FIG. 8, the user can rotate and move the selected depicted typical workstation using the zoom icon 162 and the move icon 164, respectively. The depiction of the workstation can also be moved and rotated using the pointer device positioned on the object and then moved around the screen area. In this way the user can view the workstation from various angles and positions.

Preferably the image is displayed in a selected color and with a selected texture, that is, in the color and texture of the actual product. Selection of color and texture will be described below.

At any time, the typical configuration displayed on the screen can be modified by the user. This modification can be in the form of adding or removing components, changing the shape, size or color of a component or changing the properties of a component.

While viewing a configuration, the user can select product options. In order to pick product options, the user points and clicks the pointer device on the select material icon 148 on the screen 126. This causes the computer 100 to display the various materials screen on the display 110.

The properties screen allows the user to specify a workstation at a detailed level. Every attribute of every part in the workstation can be selected to create a customer's configuration which is then displayed on the screen. The system only allows a user to select valid attributes for each particular component. In that way each displayed configuration is consistent and valid as to its attributes.

In order for the user to resize or reshape components, as shown in FIG. 9, the user selects the component 182 to be changed using the pointing device 104. When this is done,

the selected component becomes highlighted on the screen and arrows (184-192) are shown to depict the various directions in which the part can be resized. The selected part 182 can also be repositioned at another location.

The order generation system 114 will only allow components to be resized or reshaped to valid shapes. To ensure this requirement, the user interface 118 checks each resize and reshape operation, while it is ongoing, using the product attribute database 120. However, components can be moved to temporarily invalid locations. As described below, if a component is moved, the configuration will have to be checked and may have to be changed.

In the example shown in FIG. 9, after the user has resized the component, the support 189 is too long. When the user selects the configuration option 150, the graphical user interface 118 invokes the modelling tool 116 which will replace the support 189 with one of the correct length.

The user can apply fabric and finishes to a typical product by selecting the select material icon 146 with the pointer device 104. This enables the user to change all fabric and finish options on each individual component or on all components. When the user selects the select material icon 146, order generation system 114 presents the user with fabric color and finish options on the screen as shown in FIG. 10. The order generation system 114 will only allow the user to change fabric or finish to valid (manufacturable components in the product line) options for the current components. In this way, the configuration depicted on the screen is always valid with respect to its fabric and finish. In order for the user to change a fabric or color, the user selects the appropriate option from those shown on the screen. The fabrics/colors are presented in families (three families in the example in FIG. 10), so that selecting one color for a particular component will change the other parts of that component to the appropriate color from the family.

If, at any time, the user wants to capture an image of the configuration depicted on the screen, the user can select the snapshot icon 152 which causes the rendered image to be enhanced by sharpening and adding depth. These images can then be printed or cut and pasted into other applications.

The user can add components to the depicted typical by selecting the component icon 140 with the pointer device. This causes the order generation system 114 to present the user with a selection of components which can be added to the configuration (FIG. 10). The selection includes shelves, panels, storage areas and the like. Generally any component from the product line can be added to a configuration.

Once a particular component is selected, the user positions that component on the typical configuration. The order generation system 114 will allow the user to position the component at an invalid location, since it is assumed that the entire configuration will be checked, and possibly adjusted, later. Thus, for example, the user is able to put a shelf on a panel that cannot support the shelf. This is acceptable since later the system will be reconfigured to replace the panel with one which can support the shelf. Alternatively, if no supporting panel is available in the product line, the shelf will not be added.

In order to check the validity (that is, if it can be manufactured from the specified product line and is otherwise a valid configuration) of a modified workstation, the user selects the configuration check icon 150 from the screen 126. This causes the order generation system 114 to invoke the checker module which ensures validity of the depicted configuration. Generally, the modelling tool 116 may indicate that the configuration is not feasible, feasible or it may provide various modifications. For example, it may recog-

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nize that one component may be split into two or vice versa. It will insert the appropriate support structure to ensure that the configuration can be built.

Once the modelling tool 116 is done with its processing, it returns control to the user.

Once the user is satisfied with a particular typical configuration for a workspace, the user can generate a cluster of those typicals. In order to do this the user selects the "cluster" icon 144 from the screen 126. This causes the order generation system 114 to present the user with various clustering options (FIG. 12). The user can then select one of the displayed clustering options and the order generation system 114 generates the appropriate cluster of the current typical.

In generating a cluster of typicals, the order generation system 114 invokes the modelling tool 116 to ensure that the cluster is feasible. The modelling tool 116 removes redundant structures such as common walls and replaces multiple parts with individual parts if possible. If necessary the modelling tool 116 also checks the typical to ensure that it is a valid configuration.

When done, the modelling tool 116 presents the user with a display of the selected cluster of typicals as shown in FIG. 13.

The user can add other detached items such as chairs to a configuration. To do this, the user selects the seating selection icon 138 from the screen 126. When this is done the

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order generation system 114 presents the user with a display of chairs such as shown in FIG. 14. The user can select one of the depicted chairs and that chair will be placed (freestanding) in the current cluster or typical.

Once the current typical and/or cluster configuration is acceptable to the user, its price can be determined using the price icon 156. Selecting the price icon 156 causes the order generation system 114 to determine the price of the entire configuration and to present it to the user as shown in FIG. 15. As can be seen from the quote depicted in FIG. 15, at this time each component item in the configuration is listed and details about that item are given. This quote is for a valid configuration and can be sent directly to the ordering department.

Alternatively, in some embodiments, when a finalized configuration is determined, the quote may be an estimate requiring checking.

As noted above, the modelling system 116 bases its determinations on the input user requirements and on information in the product attribute database. It also uses a model of the inter-relationships between the various components. An example of such a model is shown in the following tables.

In the relationship maps below, the properties are coded as follows: "L"=load bearing, "N"=Non-load bearing, "A"=Provides Aft Support, and "G"=Supplies Ground (Floor) Support.

Environments			9000
Service Parts			9000
Interdependant Systems			9000
Casegood Systems			9000
Hanging Units			3000
Hanging Shelves			3000
	premise_shelf	PRM	3000
	places_display_shelf	PLC	3000
	places_media_shelf	PLC	3000
	places_mini_corner_shelf	PLC	3000
	places_mini_end_of_run_shelf	PLC	3000
	places_mini_straight_shelf	PLC	3000
	places_monitor_shelf	PLC	3000
	places_pass_through_shelf	PLC	3000
	places_shelf	PLC	3000
	places_shelf_with_coat_rod	PLC	3000
	signature_media_shelf	UNI	3000
	signature_shelf	UNI	3000
	signature_shelf_with_coat_rod	UNI	3000
Hanging Lateral Files			3000
	places_hanging_lateral_file	PLC	3000
	signature_hanging_lateral_file	UNI	3000
Hanging Storage Units			3000
	premise_overhead_unit	PRM	3000
	places_overhead_unit	PLC	3000
	places_shelf_with_flipper_door	PLC	3000
Attached Units			4000
Attached Peds			4000
	premise_attached_pedestal	PRM	4000
	places_attached_fundamental_pedestal	PLC	4000
	places_attached_pedestal	PLC	4000
	signature_attached_fundamental_pedestal	UNI	4000
	signature_attached_pedestal	UNI	4000
Attached Lateral Files			4000
	premise_attached_lateral_file	PRM	4000
	places_attached_lateral_file	PLC	4000
Attached Bridges			4000
	premise_bridge	PRM	4000
	places_bridge	PLC	4000
	places_transition_bridge	PLC	4000

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Attached Cabinets			4000
Upper Attached Cabinets			4000
new_views_upper_unit	PLC		4000
series_950_overfile	PLC		4000
Lower Attached Cabinets			4000
premise_attached_storage_unit	PRM		4000
new_views_lower_unit	PLC		4000
places_credenza_door_unit	PLC		4000
Attached Corner Units			4000
premise_corner_unit	PRM		4000
premise_wrap_around_unit	PRM		4000
places_corner_unit	PLC		4000
Attached Convergent Units			4000
premise_convergent_unit	PRM		4000
premise_convergent_wrap_around_d_unit	PRM		4000
places_convergent_unit	PLC		4000
Attached Conference End Units			4000
premise_conference_end_unit	PRM		4000
Attached Returns			4000
premise_return	PRM		4000
places_return	PLC		4000
places_transition_return	PLC		4000
Attached Vertical Storage Units			4000
premise_vertical_storage_unit	PRM		4000
places_vertical_storage_unit	PLC		4000
Attached Casegoods Shelves			4000
premise_bookcase_shelf	PRM		4000
premise_storage_unit_shelf	PRM		4000
places_bookcase_shelf	PLC		4000
places_storage_unit_shelf	PLC		4000
places_wardrobe_shelf	PLC		4000
series_950_bookcase_shelf	PLC		4000
series_950_cabinet_shelf	PLC		4000
series_950_overfile_shelf	PLC		4000
Attached Credenzas			4000
places_attached_credenza	PLC		4000
series_950_credenza_file	PLC		4000
Mobile Units			8000
Mobile Peds			8000
premise_mobile_pedestal	PRM		8000
places_mobile_pedestal	PLC		8000
unigroup_mobile_pedestal	ENR		8000
Mobile Tables			8000
premise_mobile_conference_end_table	PRM		8000
premise_mobile_teardrop_table	PRM		8000
places_mobile_conference_end_table	PLC		8000
places_mobile_keyboard_table	PLC		8000
places_mobile_machine_table	PLC		8000
places_mobile_round_table	PLC		8000
places_mobile_teardrop_table	PLC		8000
unigroup_mobile_keyboard_table	ENR		8000
unigroup_mobile_machine_table	ENR		8000
Mobile Storage Units			8000
new_views_mobile_cabinet	PLC		8000
Stationary Units			9000
Stationary Peds			9000
places_stationary_fundamental_pedestal	PLC		9000
places_stationary_pedestal	PLC		9000
unigroup_stationary_fundamental_pedestal	ENR		9000
unigroup_stationary_pedestal	ENR		9000
Stationary Tables			9000
premise_rectangular_table	PRM		9000
premise_round_table	PRM		9000
premise_stationary_conference_end_table	PRM		9000
premise_stationary_teardrop_table	PRM		9000
places_c_leg_table	PLC		9000
places_oval_table	PLC		9000
places_mccrack_table	PLC		9000
places_rectangular_table	PLC		9000
places_square_table	PLC		9000
places_stationary_conference_end_table	PLC		9000
places_stationary_machine_table	PLC		9000
places_stationary_round_table	PLC		9000
places_stationary_teardrop_table	PLC		9000
places_table_desk	PLC		9000

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	unigroup_oval_table	UNI	9000
	unigroup_rectangular_table	UNI	9000
	unigroup_round_table	UNI	9000
	unigroup_square_table	UNI	9000
Stationary Vertical Files			9000
Stationary Lateral Files			9000
	premise_stationary_lateral_file	PRM	9000
	places_stationary_lateral_file	PLC	9000
	series_950_combination_lateral_file	PLC	9000
	series_950_lateral_file	PLC	9000
Stationary Bookcases			9000
	premise_bookcase	PRM	9000
	places_bookcase	PLC	9000
	series_950_bookcase	PLC	9000
Stationary Desks			9000
	premise_desk	PRM	9000
	places_desk	PLC	9000
Stationary Credenzas			9000
	premise_credenza	PRM	9000
	places_stationary_credenza	PLC	9000
Stationary Wardrobes			9000
	places_wardrobe	PLC	9000
	series_950_wardrobe	PLC	9000
Stationary Cabinets			9000
	premise_stationary_storage_unit	PRM	9000
	new_views_stationary_cabinet	PLC	9000
	new_views_storage_cabinet	PLC	9000
	places_stationary_storage_unit	PLC	9000
	series_950_storage_cabinet	PLC	9000
Suspended Units			3000
Suspended Peds			3000
	places_suspended_fundamental_pedestal	PLC	3000
	places_suspended_pedestal	PLC	3000
	unigroup_suspended_fundamental_pedestal	UNI	3000
	unigroup_suspended_pedestal	UNI	3000
Suspended Drawers			3000
	premise_pencil_drawer	PRM	3000
	places_pencil_drawer	PLC	3000
	places_steel_pencil_drawer	PLC	3000
	places_wood_pencil_drawer	PLC	3000
Casegood Accessories			9000
	premise_lateral_file_counterweight	PRM	9000
	premise_vertical_storage_unit_template	PRM	9000
	places_flipper_door	PLC	9000
	places_lateral_file_counterweight	PLC	9000
	places_tug_a_ped	PLC	9000
	places_vertical_storage_unit_retrofit_kit	PLC	9000
	places_vertical_storage_unit_template	PLC	9000
	series_950_bookcase_top	PLC	9000
	series_950_counterweight	PLC	9000
	series_950_credenza_double_top	PLC	9000
	series_950_credenza_single_top	PLC	9000
	series_950_lock_bar	PLC	9000
	series_950_storage_coat_rod	PLC	9000
	series_950_storage_media_bar	PLC	9000
	unigroup_flipper_door	UNI	9000
Wall Systems			1000
Verticals			1000
Vertical Bases			1000
Mobile Bases			1000
Sliders			1000
Stationary Bases			1000
Beams			1000
Privacy Screens			1000
Scaffolds			1000
Panels			1000
Premise Panels			1000
Premise Doors			1000
	premise_door	PRM	1000
Premise Glazed Panels			1000
	premise_glazed_panel	PRM	1000
Premise Solid Panels			1000
	premise_solid_panel	PRM	1000



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Places Panels			1000
Places Doors			1000
	places_door	PLC	1000
	places_double_door	PLC	1000
	subgroup_door	UNI	1000
Places Framed Panels			1000
	places_open_panel	PLC	1000
	subgroup_open_panel	UNI	1000
Places Glazed Panels			1000
Places Standard Glazed Panels			1000
	places_glazed_panel	PLC	1000
	subgroup_glazed_panel	UNI	1000
Places Gabled Glazed Panels			1000
	places_glazed_gabled_panel	PLC	1000
Places Oblique Glazed Panels			1000
	places_glazed_oblique_panel	PLC	1000
Places Solid Panels			1000
Places Standard Solid Panels			1000
	places_solid_panel	PLC	1000
	subgroup_solid_panel	UNI	1000
Places Gabled Solid Panels			1000
	places_gabled_panel	PLC	1000
Places Oblique Solid Panels			1000
	places_oblique_panel	PLC	1000
Places Beltline Solid Panels			1000
	places_beltline_panel	PLC	1000
Places Ported Solid Panels			1000
	places_ported_panel	PLC	1000
Stacked Verticals			2000
Stack Kits			2000
Pads			2000
Extender Screens			2000
Desking Screens			2000
Fan Lights			6000
	places_fanlight	PLC	6000
Modesty Panels			2000
	places_convergent_modesty_panel	PLC	2000
	places_corner_modesty_panel	PLC	2000
	places_straight_modesty_panel	PLC	2000
Vertical Accessories			9000
	places_blind_kit	PLC	9000
	places_counter_top_end_cover	PLC	9000
	places_electronic_work_surface_end_cover	PLC	9000
	places_muntin_kit	PLC	9000
	places_wainscot_kit	PLC	9000
	subgroup_electronic_work_surface_end_cover	UNI	9000
Horizontals			3000
Work Surfaces			3000
Corner Work Surfaces			3000
Height Adjustable Corner Work Surfaces			3000
	places_height_adjustable_corner_work_surface	PLC	3000
	places_height_adjustable_split_corner_work_surfa	PLC	3000
	subgroup_height_adjustable_corner_work_surface	UNI	3000
	subgroup_height_adjustable_split_corner_work_sur	UNI	3000
Regular Corner Work Surfaces			3000
	premise_corner_work_surface	PRM	3000
	premise_wrap_around_work_surface	PRM	3000
	places_corner_work_surface	PLC	3000
	places_wrap_around_work_surface	PLC	3000
	subgroup_corner_work_surface	UNI	3000
	subgroup_wrap_around_work_surface	UNI	3000
Electronic Corner Work Surfaces			3000
	places_electronic_corner_work_surface	PRM	3000
	subgroup_electronic_corner_work_surface	UNI	3000
Transitional Corner Work Surfaces			3000
	premise_transitional_wrap_around_work_surface	PRM	3000
	places_transitional_corner_work_surface	PLC	3000
	places_transitional_wrap_around_work_surface	PLC	3000
	subgroup_transitional_corner_work_surface	UNI	3000
	subgroup_transitional_wrap_around_work_surface	UNI	3000

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Rectangular Work Surfaces		3000
Height Adjustable Rectangular Work Surfaces		3000
places_height_adjustable_rectangular_work_surface	PLC	3000
unigroup_height_adjustable_rectangular_work_surface	UNI	3000
Regular Rectangular Work Surfaces		3000
Premise Regular Rectangular Work Surfaces		3000
premise_radiused_rectangular_work_surface	PRM	3000
premise_rectangular_work_surface	PRM	3000
premise_split_rectangular_work_surface	PRM	3000
Places Regular Rectangular Work Surfaces		3000
places_monitor_work_surface	PLC	3000
places_radiused_rectangular_work_surface	PLC	3000
places_rectangular_work_surface	PLC	3000
places_rectangular_work_surface_top	PLC	3000
places_split_rectangular_work_surface	PLC	3000
unigroup_monitor_rectangular_work_surface	UNI	3000
unigroup_rectangular_work_surface	UNI	3000
unigroup_rectangular_work_surface_top	UNI	3000
unigroup_split_rectangular_work_surface	UNI	3000
Electronic Rectangular Work Surfaces		3000
places_electronic_rectangular_work_surface	PLC	3000
unigroup_electronic_rectangular_work_surface	UNI	3000
Transitional Rectangular Work Surfaces		3000
premise_transitional_rectangular_work_surface	PRM	3000
places_transitional_rectangular_work_surface	PLC	3000
unigroup_transitional_rectangular_work_surface	UNI	3000
Convergent Work Surfaces		3000
Regular Convergent Work Surfaces		3000
premise_convergent_work_surface	PRM	3000
places_convergent_work_surface	PLC	3000
unigroup_convergent_work_surface	UNI	3000
Shaped Convergent Work Surfaces		3000
premise_shaped_wrap_around_work_surface	PRM	3000
places_shaped_wrap_around_work_surface	PLC	3000
unigroup_shaped_wrap_around_work_surface	UNI	3000
Conference Ends		3000
Regular Conference Ends		3000
premise_conference_end_work_surface	PRM	3000
places_conference_end_work_surface	PLC	3000
unigroup_conference_end_work_surface	UNI	3000
Single Run Conference Ends		3000
premise_curved_work_surface	PRM	3000
premise_teardrop_end_work_surface	PRM	3000
places_curved_work_surface	PLC	3000
places_d_shaped_end_work_surface	PLC	3000
places_teardrop_end_work_surface	PLC	3000
unigroup_curved_work_surface	UNI	3000
unigroup_teardrop_end_work_surface	UNI	3000
Countertops		3000
Straight Countertops		3000
premise_rectangular_counter_top	PRM	3000
places_rectangular_counter_top	PLC	3000
places_wheelchair_reception_counter_top	PLC	3000
unigroup_rectangular_counter_top	UNI	3000
Corner Countertops		3000
places_corner_counter_top	PLC	3000
unigroup_corner_counter_top	UNI	3000
Horizontal Accessories		3000
premise_keyboard_holders	PRM	3000
premise_mouse_pad	PRM	3000
premise_palm_rest	PRM	3000
places_carousel	PLC	3000
places_corner_canopy	PLC	3000
places_electronic_transition_cover	PLC	3000
places_keyboard_holders	PLC	3000
places_make_a_corner	PLC	3000
places_mouse_pad	PLC	3000
places_palm_rest	PLC	3000

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	unigroup_cornwall	UNI	3000
	unigroup_keyboard_holder	UNI	3000
	unigroup_make_a_corner	UNI	3000
	unigroup_mouse_pad	UNI	3000
	unigroup_palm_rest	UNI	3000
Table Tops			3000
Vertical Supports			7000
Covers			7000
Finish Covers			7000
	premise_variable_height_cover	PRM	7000
	places_canopy_finish_post	PLC	7000
	places_electrical_end_cap	PLC	7000
	places_end_of_run_post	PLC	7000
	places_finish_post	PLC	7000
	places_variable_end_of_run_post	PLC	7000
	unigroup_electrical_end_cap	UNI	7000
	unigroup_end_of_run_post	UNI	7000
	unigroup_finish_post	UNI	7000
	unigroup_variable_end_of_run_post	UNI	7000
Electrical Covers			7000
	new_views_base_cover_kit	PLC	7000
	places_180_connector_cover	PLC	7000
	places_90_connector_cover	PLC	7000
	unigroup_180_connector_cover	UNI	7000
	unigroup_90_connector_cover	UNI	7000
Connectors			7000
T-Mount Kit			7000
	new_views_t_mount_bracket	PLC	7000
Standard Connectors			7000
	premise_connector	PRM	7000
	places_hinge	PLC	7000
	unigroup_hinge	UNI	7000
Modesty Panel Supports			7000
	places_modesty_to_cabinet_bracket	PLC	7000
	places_modesty_to_panel_bracket	PLC	7000
Posts			7000
Upper Posts			7000
Lower Posts			7000
Architectural Connections			7000
Horizontal Supports			7000
Table Bases			7000
Brackets			7000
Panel Attached Brackets			7000
	premise_pedestal_to_panel_bracket	PRM	7000
	premise_work_surface_cantilever	PRM	7000
	premise_work_surface_corner_bracket	PRM	7000
	places_included_work_surface_cantilever	PLC	7000
	places_work_surface_cantilever	PLC	7000
	places_work_surface_corner_bracket	PLC	7000
	places_work_surface_panel_mount	PLC	7000
	places_work_surface_side_mount	PLC	7000
	places_work_surface_slope_mount	PLC	7000
	series_950_credenza_file_work_surface_support	PLC	7000
	unigroup_work_surface_cantilever	UNI	7000
	unigroup_work_surface_panel_mount	UNI	7000
	unigroup_work_surface_side_mount	UNI	7000
	unigroup_work_surface_slope_mount	UNI	7000
Non-Panel Attached Brackets			7000
	premise_work_surface_drop_mount	PRM	7000
	premise_work_surface_flush_mount	PRM	7000
	new_views_cabinet_to_work_surface_bracket	PLC	7000
	places_work_surface_drop_mount	PLC	7000
	places_work_surface_flush_mount	PLC	7000
	unigroup_work_surface_drop_mount	UNI	7000
	unigroup_work_surface_flush_mount	UNI	7000
Legs			7000
	premise_work_surface_support_leg	PRM	7000
	places_work_surface_support_leg	PLC	7000
	unigroup_work_surface_support_leg	UNI	7000
Worksurface Support Panels			7000
	premise_work_surface_support_panel	PRM	7000
	places_conference_end_support	PLC	7000

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	places_work_surface_end_full_support_panel	PLC	7000
	places_work_surface_end_half_support_panel	PLC	7000
	places_work_surface_support_panel	PLC	7000
	unigroup_work_surface_support_panel	UNI	7000
Height Adjustment Kits			7000
	premise_lateral_file_height_adjustment_kit	PRM	7000
	premise_pedestal_height_adjustment_kit	PRM	7000
Adjustable Supports	premise_storage_unit_height_adjustment_kit	PRM	7000
	places_height_adjustable_corner_mechanism	PLC	7000
	places_height_adjustable_rectangular_mechanism	PLC	7000
	places_height_adjustable_split_corner_mechanism	PLC	7000
	unigroup_height_adjustable_corner_mechanism	UNI	7000
	unigroup_height_adjustable_rectangular_mechanism	UNI	7000
	unigroup_height_adjustable_split_corner_mechanism	UNI	7000
Seating			8000
Auditorium Seating			8000
Adjustable Seating			8000
	accolade_caster_base_chair	STG	8000
	accolade_caster_base_stool	STG	8000
	improv_caster_base_chair	STG	8000
	improv_he_caster_base_chair	STG	8000
Stackable Seating			8000
	improv_leg_base_stacking_chair	STG	8000
Non-Adjustable Seating			8000
	accolade_sled_base_chair	STG	8000
	improv_leg_base_stool	STG	8000
	improv_sled_base_chair	STG	8000
Lounge Seating			8000
Benches			8000
Single Lounge Seating			8000
Multiple Lounge Seating			8000
Power and Data			5000
Power and Data Providers			5000
In-Feeds			5000
	premise_base_feed_module	PRM	5000
	premise_top_feed_module	PRM	5000
	places_base_feed_module	PLC	5000
	places_top_feed_module	PLC	5000
	unigroup_base_feed_module	UNI	5000
	unigroup_top_feed_module	UNI	5000
Out-Feeds			5000
	premise_base_igr_receptacle	PRM	5000
	premise_base_receptacle	PRM	5000
	premise_panel_communications_port_kit	PRM	5000
	premise_panel_power_port_kit	PRM	5000
	places_base_igr_receptacle	PLC	5000
	places_base_igr_surge_protector_receptacle	PLC	5000
	places_base_receptacle	PLC	5000
	places_smart_work_surface_power_module	PLC	5000
	places_switching_system_kit	PLC	5000
	places_switching_system_power_supply	PLC	5000
	places_switching_system_receptacle	PLC	5000
	places_switching_system_wall_switch	PLC	5000
	places_work_surface_duplex_receptacle	PLC	5000
	places_work_surface_power_module	PLC	5000
	unigroup_base_igr_receptacle	UNI	5000
	unigroup_base_igr_surge_protector_receptacle	UNI	5000
	unigroup_base_receptacle	UNI	5000
	unigroup_smart_work_surface_power_module	UNI	5000
	unigroup_work_surface_duplex_receptacle	UNI	5000
	unigroup_work_surface_power_module	UNI	5000
Power and Data Routers			5000
Power and Data Channels			5000
	premise_vertical_wire_manager	PRM	5000
	places_cable_management_post	PLC	5000
	places_horizontal_wire_manager_33in	PLC	5000
	places_horizontal_wire_manager_40in	PLC	5000
	places_variable_height_cable_management_post	PLC	5000
	unigroup_cable_management_post	UNI	5000
	unigroup_horizontal_wire_manager	UNI	5000
	unigroup_vertical_wire_manager	UNI	5000

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Power and Data Connectors				
	premise_extended_power_connector	PRM		5000
	premise_flexible_power_connector	PRM		5000
	premise_straight_span_power_connector	PRM		5000
	places_base_to_beltline_power_connector	PLC		5000
	places_beltline_to_beltline_power_connector	PLC		5000
	places_extended_power_connector	PLC		5000
	places_flexible_power_connector	PLC		5000
	places_straight_power_connector	PLC		5000
	unigroup_extended_power_connector	UNI		5000
	unigroup_flexible_power_connector	UNI		5000
	unigroup_straight_power_connector	UNI		5000
Cable Management				
	premise_grommet	PRM		5000
	premise_wire_management_loop	PRM		5000
	places_cable_management_beltline_cover_plate	PLC		5000
	places_cable_management_ported_cover_plate	PLC		5000
	places_cable_management_top_cap	PLC		5000
	places_grommet	PLC		5000
	places_wire_basket	PLC		5000
	places_wire_management_loop	PLC		5000
	places_wire_management_module	PLC		5000
	places_wire_manager	PLC		5000
	places_work_surface_power_module_storage	PLC		5000
	unigroup_work_surface_power_module_storage	UNI		5000
	unigroup_wire_basket	UNI		5000
	unigroup_wire_management_loop	UNI		5000
Lighting				
Horizontally Mounted Lighting				
	premise_task_light	PRM		6000
	premise_vertical_storage_task_light_bracket	PRM		6000
	places_canopy_light	PLC		6000
	places_counter_top_task_light	PLC		6000
	places_freestanding_pivot_head_task_light	PLC		6000
	places_task_light			6000
	unigroup_counter_top_task_light	UNI		6000
	unigroup_freestanding_pivot_head_task_light	UNI		6000
	unigroup_task_light	UNI		6000
Vertically Mounted Lighting				
	places_grid_hung_pivot_head_task_light	PLC		6000
	places_panel_hung_fluorescent_light	PLC		6000
	places_panel_hung_pivot_head_task_light	PLC		6000
	places_panel_mounted_fluorescent_light	PLC		6000
	places_post_mount_street_light	PLC		6000
	places_street_light	PLC		6000
	unigroup_grid_hung_pivot_head_task_light	UNI		6000
	unigroup_panel_hung_fluorescent_light	UNI		6000
	unigroup_panel_hung_pivot_head_task_light	UNI		6000
	unigroup_panel_mounted_fluorescent_light	UNI		6000
	unigroup_post_mount_street_light	UNI		6000
	unigroup_street_light	UNI		6000
Floor Mounted Lighting				
Lighting Accessories				
	places_fluorescent_light_saddle_mount_kit	PLC		6000
	places_painted_shelf_task_light_bracket	PLC		6000
	places_vertical_storage_task_light_bracket	PLC		6000
	places_wood_shelf_task_light_bracket	PLC		6000
	unigroup_fluorescent_light_saddle_mount_kit	UNI		6000
	unigroup_shelf_task_light_bracket	UNI		6000
Organization				
Tackable Surfaces				
	premise_tackboard	PRM		9000
	places_grid_tackstrip	PLC		9000
	places_tackboard	PLC		9000
	unigroup_tackboard	UNI		9000
Markable Surfaces				
	premise_markerboard	PRM		9000
	places_markerboard	PLC		9000
	unigroup_markerboard	UNI		9000

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Workflow Devices			9000
Vertical Workflows			9000
	premise_all_purpose_hook	PRM	9000
	premise_lateral_file_drawer_compressor	PRM	9000
	premise_lateral_file_drawer_divider	PRM	9000
	premise_lateral_file_front_to_back_hanging_bar	PRM	9000
	premise_lateral_file_side_to_side_hanging_bar	PRM	9000
	premise_pedestal_drawer_divider	PRM	9000
	premise_shelf_divider	PRM	9000
	paper_management_bar	PLC PRM	9000
	paper_management_freestanding_vertical_unit	PLC PRM	9000
	paper_management_suspended_vertical_unit	PLC PRM	9000
	new_views_shelf_divider	PLC	9000
	places_all_purpose_hook	PLC	9000
	places_fundamental_pedestal_hanging_bar	PLC	9000
	places_fundamental_pedestal_side_to_side_divide	PLC	9000
	places_lateral_file_front_to_back_hanging_bar	PLC	9000
	places_organization_grid	PLC	9000
	places_shelf_divider	PLC	9000
	places_vertical_storage_unit_grid	PLC	9000
	tri_mode_paper_management_bar	PLC UN	9000
	tri_mode_vertical_unit	PLC UN	9000
	series_950_drawer_compressor	PLC	9000
	series_950_drawer_divider	PLC	9000
	series_950_front_to_back_hanging_bar	PLC	9000
	series_950_side_to_side_hanging_bar	PLC	9000
	undergroup_all_purpose_hook	UN	9000
	undergroup_shelf_divider	UN	9000
Horizontal Workflows			9000
	premise_pedestal_pencil_tray	PRM	9000
	paper_management_freestanding_horizontal_unit	PLC PRM	9000
	paper_management_suspended_horizontal_unit	PLC PRM	9000
	paper_management_trays	PLC PRM	9000
	paper_management_under_shelf_unit	PLC	9000
	places_freestanding_grid_mailbox	PLC	9000
	places_fundamental_pedestal_tray	PLC	9000
	places_grid_mailbox	PLC	9000
	places_grid_reference_tray	PLC	9000
	tri_mode_divider	PLC UN	9000
	tri_mode_hanger_clip	PLC UN	9000
	tri_mode_horizontal_shelves	PLC UN	9000
	tri_mode_horizontal_unit	PLC UN	9000
Diagonal Workflows			9000
	paper_management_freestanding_diagonal_unit	PLC PRM	9000
	paper_management_suspended_diagonal_unit	PLC PRM	9000
	tri_mode_diagonal_unit	PLC UN	9000
Workflow Bins			9000
	places_grid_diskette_bin	PLC	9000
	places_grid_storage_bin	PLC	9000
Services			9000

Class Structure	Component Name Line	Prod	Relationship Maps			Light Weight L# Relationships
			Inherits From	Constraint C#	Relationships	
Environments			N/A			1 "LWC: Environments" (Overridden at lower class levels)
Service Parts			\$A\$3			???
Interdependant Systems			N/A			???
Casegood Systems			\$B\$5			???
Hangng Units			\$C\$6	1 "Hang Stuff" AND "HU"		1 "LW Hang Stuff"
Hangng Shelves			\$D\$7	Inh		Inh
	premise_shelf PRM					Inh
	places_display_shelf PLC					Inh
	places_media_shelf PLC					Inh
	places_mini_corner_shelf PLC					Inh
	places_mini_end_of_run_shelf PLC					Inh
	places_mini_straight_shelf PLC					Inh
	places_monitor_shelf PLC					Inh
	places_pass_through_shelf PLC					Inh
	places_shelf PLC					Inh
	places_shelf_with_coat_rod PLC					Inh
Attached Units			\$C\$6	1 if attaching to a member of X_Credenzas or X_Desks, must attach to the "open" front		1 Override x/z_pos such that panel bisects shelf
Attached Peds			\$D\$25	1 "AP"		1 "Set AP Depth" and "Place Storage"
	premise_attached_pedestal PRM	AFG				Inh
	places_attached_fundamental_pedestal PLC	AFG		1 "AP prm-ap"		Inh
Attached Lateral Files			\$D\$25	1 "ALF"		1 "Set AP Depth" and "Place Storage"
	premise_attached_lateral_file PRM	AFG				Inh
	places_attached_lateral_file PLC			1 "ALF"		1 "Place Storage"
Attached Bridges			\$D\$25	1 "AB"		1 "Center on Floor" AND "Attach Bridge/Return"
	premise_bridge PRM					Inh
	places_bridge PLC					Inh
	places_transition_bridge PLC					Inh
Attached Cabinets			\$D\$25			
Upper Attached Cabinets			\$E\$37	1 "UAC av-u"		???
	new_views_upper_unit PLC			???	Must sit on top of ???	???
Lower Attached Cabinets			\$E\$37	1 "LAC"		???
	premise_attached_storage_unit PRM			1 "LAC prm-asu"		???
	new_views_lower_unit PLC			1 "LAC av-lu"		1 "Center on Floor" and "Set LWC Position Attached Lateral File And Storage Unit"
Attached Corner Units			\$D\$25	???		???
	places_credenza_door_unit PLC			1 Both sides must attach to a member of Attached_Returns/Bridges/Credenzas/Desks		1 "Center on Floor"
	premise_corner_unit PRM					Inh
	premise_wrap_around_unit PRM					Inh
	places_corner_unit PLC					Inh

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Class Structure	Relationship Maps					Light Weight L# Relationships
	Inherits From	Properties	Component Name	Prod Line	Constraint C# Relationships	
Attached Convergent Units			premise_convergent_unit	PRM	1 "AConvU"	1 "Center on Floor"
			premise_convergent_wrap_around_d_unit	PRM	Inh	Inh
			places_convergent_unit	PLC	Inh	Inh
Attached Conference End Units			premise_conference_end_unit	PRM	SD\$25	1 "Center on Floor"
Attached Returns			premise_return	PRM	SD\$25	1 "Center on Floor"
			places_return	PLC	Inh	Inh
			places_transition_return	PLC	1 If 30" panel used as return, WS must use brackets, not cantilevers	Inh
Attached Vertical Storage Units			premise_vertical_storage_unit	PRM	SD\$25	1 "Center of Floor"
Attached Casegoods Shelves			places_vertical_storage_unit	PLC	1 If 30" panel used as return, WS must use brackets, not cantilevers	Inh
			premise_bookcase_shelf	PRM	SD\$25	1 "Center of Floor"
			places_bookcase_shelf	PLC	Inh	Inh
Attached Credenzas			premise_storage_unit_shelf	PRM	n/a ACCESSORY	1 IWC: ACS
			places_storage_unit_shelf	PLC	n/a ACCESSORY	n/a ACCESSORY
			places_storage_unit_shelf	PLC	n/a ACCESSORY	n/a ACCESSORY
			places_wardrobe_shelf	PLC	n/a ACCESSORY	n/a ACCESSORY
			series_951_bookcase_shelf	PLC	n/a ACCESSORY	n/a ACCESSORY
			series_951_cabinet_shelf	PLC	n/a ACCESSORY	n/a ACCESSORY
			series_951_overfile_shelf	PLC	n/a ACCESSORY	n/a ACCESSORY
			places_attached_credenza	PLC	SD\$25	1 "Center on Floor"
			series_951_credenza_file	PLC	1 Must attach to a member of X_Corners or X_Desks	1 "Center on Floor"
					Inh	Inh
Mobile Units Mobile Peds						
Mobile Tables			premise_mobile_pedestal	PRM	SD\$36	1 "Center on Floor"
			places_mobile_pedestal	PLC	SD\$75	Inh
					Inh	Inh
			premise_mobile_conference_end_table	PRM	SD\$75	Inh
			premise_mobile_tendrop_table	PRM	Inh	Inh
			places_mobile_conference_end_table	PLC	Inh	Inh
			places_mobile_keyboard_table	PLC	Inh	Inh
Mobile Storage Units			places_mobile_machine_table	PLC	Inh	Inh
			places_mobile_round_table	PLC	Inh	Inh
			places_mobile_tendrop_table	PLC	Inh	Inh
			new_views_mobile_cabinet	PLC	SD\$75	Inh



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Class Structure	Component Name	Prod Line	Relationship Maps			Light Weight L# Relationships
			Inherits From	C#	Constraint Relationships	
Stationary Units						
Stationary Peds						
	places_stationary_fundamental_pedestal	PLC	\$C36	1	Must sit on floor	1 "Center on Floor"
	places_stationary_pedestal	PLC		???	\$D\$88	Inh
Stationary Tables						
	premise_rectangular_table	PRM	\$D\$88	???		Inh
	premise_round_table	PRM		???		Inh
	premise_stationary_conference_end_table	PRM		???		Inh
	premise_stationary_teardrop_table	PRM		???		Inh
	places_c_fig_table	PLC		???		Inh
	places_oval_table	PLC	???		Inh	
	places_race-track_table	PLC		???		Inh
	places_rectangular_table	PLC		???		Inh
	places_square_table	PLC		???		Inh
	places_stationary_conference_end_table	PLC		???		Inh
	places_stationary_machine_table	PLC		???		Inh
	places_stationary_round_table	PLC		???		Inh
	places_stationary_teardrop_table	PLC		???		Inh
	places_table_desk	PLC		???		Inh
Stationary Vertical Files						
Stationary Lateral Files						
	premise_stationary_lateral_file	PRM	\$D\$88	???		Inh
	places_stationary_lateral_file	PLC	\$D\$88	???	stands there - Is configurable (4 heights) - work like drawer pedestals	Inh
	series_951_combination_lateral_file	PLC			stands there - 2/3/4/5 high - settable via properties	
	series_951_lateral_file	PLC				
Stationary Bookcases						
	premise_bookcase	PRM	\$D\$88	Inh		Inh
	places_bookcase	PLC		Inh		Inh
	series_951_bookcase	PLC		Inh	2/3/4/5 high - settable via properties	Inh
Stationary Desks						
	premise_desk	PRM		???		Inh
	places_desk	PLC		???		Inh
Stationary Credenzas						
	premise_credenza	PRM	\$D\$88	???		Inh
	places_stationary_credenza	PLC		???		Inh
Stationary Wardrobes						
	places_wardrobe	PLC	\$D\$88	???		Inh
	series_951_wardrobe	PLC		???	Stands there, only 1 size (uses series_951_storage_cabinet metafile)	Inh
Stationary Cabinets						
	premise_stationary_storage_unit	PRM	\$D\$88	???		Inh
	new_views_stationary_cabinet	PLC		Inh		Inh
	new_views_storage_cabinet	PLC		Inh		Inh

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Class Structure	Component Name	Prod Line	Relationship Maps			Light Weight L# Relationships	
			Inherits From	Constraint C#	Relationships		
Suspended Units Suspended Peds	places_stationary_storage_unit PLC series_951_storage_cabinet PLC			Inh	Stands there - 4 or 5 high - no shelves or 3 shelves	Inh	
	places_suspended_fundamental_pedestal PLC places_suspended_pedestal PLC		\$C\$6 \$D\$132	1 Inh	Mounts under WS, Return, Desk, or Credenza -	1 "Place Storage" AND "LWC: Set SP Depth/Pos"	
			\$D\$132	1 Inh	Must Mount to Front Edge of Worksurface	Inh	
		premise_pencil_drawer PRM places_pencil_drawer PLC				???	
		places_steel_pencil_drawer PLC places_wood_pencil_drawer PLC				???	
	Casegood Accessories					???	
				\$C\$6			
		premise_lateral_file_counterweight PRM premise_vertical_storage_unit_plate PRM places_flipper_door PLC			Dep Dep ???	ACCESSORY ACCESSORY ACCESSORY	n/a ACCESSORY (Note: 1 included with 2-highs) n/a ACCESSORY ???
		places_lateral_file_counterweight PRM places_tug_a_ped PLC			Dep Dep	ACCESSORY ACCESSORY	n/a ACCESSORY (Note: 1 included with 2-highs) n/a ACCESSORY
		places_vertical_storage_unit_retrofit_kit PLC places_vertical_storage_unit_template PLC			Dep n/a	ACCESSORY ACCESSORY	n/a ACCESSORY n/a ACCESSORY
series_950_bookcase_top PLC series_950_counterweight PLC series_950_credenza_double_top PLC series_950_credenza_single_top PLC series_950_lock_bar PLC series_950_storage_coat_rod PLC series_950_storage_media_bar PLC				n/a n/a n/a n/a n/a n/a n/a	Must be the same size as target bookcase contiguous top for 2 bins of same height and width used when a CF is in the open ACCESSORY ACCESSORY ACCESSORY	n/a ACCESSORY n/a ACCESSORY n/a ACCESSORY n/a ACCESSORY	
Wall Systems Verticals Mobile Bases Sliders Stationary Bases Beams Privacy Screens Scaffolds Panels Premise_Panels Premise_Doors Premise Glazed Panels Premise Solid Panels			\$B\$5 \$C\$156 \$D\$157 \$E\$158 \$F\$159 \$E\$158 \$F\$161 \$F\$161 \$F\$161 \$F\$161 \$G\$165 \$H\$166 \$H\$166 \$H\$166	1 1 1 1 1 1 1 1 1 1 1 1 1 1	Panels Require Support (Physical Constraint) "PRM Panels" "PRM Doors"	1 "LWC: Panels"	

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Class Structure	Relationship Maps					Light Weight L# Relationships
	Component Name	Prod Line	Properties From	Inherits From	Constraint Relationships	
Places Panels Places Doors						
Places Framed Panels						
Glazed Panels Standard Glazed Panels						
Gabled Glazed Panels bi-que Glazed Panels						
Solid Panels Standard Solid Panels						
Gabled Solid Panels Oblique Solid Panels						
Belline Solid Panels Ported Solid Panels						
Stacked Verticals Stack Kits Pads Extender Screens Desktop Screens Pen Lights						
Modesty Panels						
Vertical Accessories						

## -continued

Class Structure	Component Name	Line	Prod	Relationship Maps			Light Weight L# Relationships
				Inherits From	C#	Constraint Relationships	
	places_electronic_work_surface_end_cover	PLC					
	places_muntin_kit	PLC					
	places_wainscot_kit	PLC					
Horizontals							
Work Surfaces							
Corner Work Surfaces							
Height Adjustable Corner Work Surfaces							
	places_height_adjustable_corner_work_surface	PLC					
	places_height_adjustable_split_corner_work_surface	PLC					
Regular Corner Work Surfaces							
	premise_corner_work_surface	PRM					
	premise_wrap_around_work_surface	PRM					
	places_corner_work_surface	PLC					
	places_wrap_around_work_surface	PLC					
Electronic Corner Work Surfaces							
	places_electronic_corner_work_surface	PLC					
Transitional Corner Work Surfaces							
	premise_transitional_wrap_around_work_surface	PRM					
	places_transitional_corner_work_surface	PLC					
	places_transitional_wrap_around_work_surface	PLC					
Rectangular Work Surfaces							
Height Adjustable Rectangular Work Surface							
	places_height_adjustable_rectangular_work_surface	PLC					
Regular Rectangular Work Surfaces							
Premise Regular Rectangular Work Surfaces							
	premise_radiused_rectangular_work_surface	PRM					
	premise_rectangular_work_surface	PRM					
	premise_split_rectangular_work_surface	PRM					
Places Regular Rectangular Work Surfaces							
	places_monitor_work_surface	PLC					
	places_radiused_rectangular_work_surface	PLC					
	places_rectangular_work_surface	PLC					
	places_rectangular_work_surface_top	PLC					
	places_split_rectangular_work_surface	PLC					
Electronic Rectangular Work Surfaces							
	places_electronic_rectangular_work_surface	PLC					

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Class Structure	Prod	Relationship Maps			Light Weight L# Relationships
		Component Name Line	Inherits From	Constraint C# Relationships	
Covers					
Finish Covers					
		premise_variable_height_cover PRM places_canopy_finish_post PLC places_electrical_end_cap PLC places_end_of_run_post PLC places_finish_post PLC places_variable_end_of_run_post PLC	\$D\$286 \$E\$287	1 Height must match panel height 1 Height/orientation should be appropriate ?? 1 Height must match difference in panel heights	
Electrical Cover		new_views_base_cover_kit PLC places_180_connector_cover PLC places_90_connector_cover PLC	\$E\$287	???	???
Connectors					
T-Mount Kit			\$D\$286 \$E\$299	1 Must sit on floor 1 Cannot position the T-mount within .82" from end of panel	
Standard Connectors		new_views_t_mount_bracket PLC premise_connector PRM places_hinge PLC	\$E\$299	Inh	Inh
Modesty Panel Supports		places_modesty_to_cabinet_bracket PLC places_modesty_to_panel_bracket PLC	\$D\$286	1 Must be as tall as the tallest panel being joined	
Posts					
Upper Posts			\$D\$286		
Lower Posts			\$E\$308 \$E\$308	n/a NOT IN PHASE I	n/a NOT IN PHASE I
Architectural Connections			\$D\$286 \$C\$156		
Horizontal Supports			\$D\$312	1 Must sit on floor	
Table Base			\$D\$312 \$E\$314		
Brackets					
Panel Attached Brackets		premise_pedestal_to_panel_bracket PRM AF (when used in pairs)			
		premise_work_surface_cantilever PRM AF		1 Unable to support 30' deep work surface with only cantilevers	n/a
		premise_work_surface_corner_bracket PRM AF		1 The long side of the bracket must align to a Panel (i.e. bracket must "clip" to a panel)	n/a
		places_included_work_surface_cantilever PLC places_work_surface_cantilever PLC places_work_surface_corner_bracket PLC places_work_surface_panel_mount PLC places_work_surface_side_mount PLC places_work_surface_slope_mount PLC series_950_credenza_file_work_surface_support PLC	n/a		n/a
				n/a NOT IN PHASE I required when cantilever in the way - use in place: provides aft support, credenza provides fore support	n/a NOT IN PHASE I

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Class Structure	Component Name	Prod Line	Relationship Maps		Light Weight L# Relationships
			Inherits From	Constraint C# Relationships	
Non-Panel Attached Brackets	premise_work_surface_drop_mount PRM		\$E\$314		
	premise_work_surface_flush_mount PRM				
	new_views_cabinet_to_work_surface_bracket PLC			Dep (brought in when NV Upper Cabinet touches a WS)	n/a
	places_work_surface_drop_mount PLC				
	places_work_surface_flush_mount PLC				
	premise_work_surface_support_leg PRM				
	places_work_surface_support_leg PLC				
	premise_work_surface_support_panel PRM				
	places_conference_end_support PLC				
	places_work_surface_end_half_support_panel PLC				
Legs	places_work_surface_support_panel PLC				
	premise_lateral_file_height_adjustment_kit PRM				
Height Adjustment Kits	premise_pedestal_height_adjustment_kit PRM				
	premise_storage_unit_height_adjustment_kit PRM				
Adjustable Supports	places_height_adjustable_corner_mechanism PLC				
	places_height_adjustable_rectangular_mechanism PLC				
Seating	laces_height_adjustable_split_corner_mechanism PLC				
Auditorium Seating					
Adjustable Seating					
Stackable Seating					
Non-Adjustable Seating					
Lounge Seating					
Benches					
Single Lounge Seating					
Multiple Lounge Seating					
Power and Data					
Power and Data Providers					
In-Feeds					

## -continued

		Relationship Maps					
Class Structure	Prod Line	Component Name	Properties	Inherits From	C#	Constraint Relationships	Light Weight L# Relationships
Out-Feeds		places_base_feed_module PLC					
		places_top_feed_module PLC					
		premise_base_igr_receptacle PRM					
		premise_base_receptacle PRM					
Power and Data Routers Power and Data Channels		premise_panel_communications_port_kit PRM					
		premise_panel_power_port_kit PRM					
		places_base_igr_receptacle PLC					
		places_base_igr_surge_protector_receptacle PLC					
		places_base_receptacle PLC					
		places_smart_work_surface_power_module PLC					
		places_switching_system_kit PLC					
		places_switching_system_power_supply PLC					
		places_switching_system_receptacle PLC					
		places_switching_system_wall_switch PLC					
Power and Data Connectors		places_work_surface_receptacle PLC					
		places_work_surface_power_module PLC					
		premise_vertical_wire_manager PRM					
		places_cable_management_post PLC					
		places_horizontal_wire_manager_33in PLC					
		places_horizontal_wire_manager_40in PLC					
		places_variable_height_cable_management_post PLC					
		premise_extended_power_connector PRM					
		premise_flexible_power_connector PRM					
		premise_straight_span_power_connector PRM					
Cable Management		places_base_to_bellline_power_connector PLC					
		places_bellline_to_bellline_power_connector PLC					
		places_extended_power_connector PLC					
		places_flexible_power_connector PLC					
		places_straight_power_connector PLC					
		premise_grommet PRM					
		premise_wire_management_loop PRM					
		places_cable_management_bellline_cover_plate PLC					
		places_cable_management_ported_cover_plate PLC					
		places_cable_management_top_cap PLC					
		places_grommet PLC					
		places_wire_basket PLC					
		places_wire_management_loop PLC					
		places_wire_management_module PLC					
Out-Feeds		places_base_feed_module PLC					
		places_top_feed_module PLC					
		premise_base_igr_receptacle PRM					
		premise_base_receptacle PRM					
		premise_panel_communications_port_kit PRM					
		premise_panel_power_port_kit PRM					
		places_base_igr_receptacle PLC					
		places_base_igr_surge_protector_receptacle PLC					
		places_base_receptacle PLC					
		places_smart_work_surface_power_module PLC					
Power and Data Routers Power and Data Channels		places_switching_system_kit PLC					
		places_switching_system_power_supply PLC					
		places_switching_system_receptacle PLC					
		places_switching_system_wall_switch PLC					
		places_work_surface_receptacle PLC					
		places_work_surface_power_module PLC					
		premise_vertical_wire_manager PRM					
		places_cable_management_post PLC					
		places_horizontal_wire_manager_33in PLC					
		places_horizontal_wire_manager_40in PLC					
Power and Data Connectors		places_variable_height_cable_management_post PLC					
		premise_extended_power_connector PRM					
		premise_flexible_power_connector PRM					
		premise_straight_span_power_connector PRM					
		places_base_to_bellline_power_connector PLC					
		places_bellline_to_bellline_power_connector PLC					
		places_extended_power_connector PLC					
		places_flexible_power_connector PLC					
		places_straight_power_connector PLC					
		premise_grommet PRM					
Cable Management		premise_wire_management_loop PRM					
		places_cable_management_bellline_cover_plate PLC					
		places_cable_management_ported_cover_plate PLC					
		places_cable_management_top_cap PLC					
		places_grommet PLC					
		places_wire_basket PLC					
		places_wire_management_loop PLC					
		places_wire_management_module PLC					
		places_base_feed_module PLC					
		places_top_feed_module PLC					



-continued

		Relationship Maps							
Class Structure	Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	Light Weight L# Relationships		
Lighting Horizontally Mounted Lighting	places_work_surface_power_module_storage	PLC			n/a	ACCESSORY 1 Mounts underneath WS	n/a ACCESSORY 1 Sits underneath WS at click_x, click_z		
				\$B\$366		1 Requires receptacle within 72 linear inches from the left or right back corner (on the supporting or either adjacent panel)			
	premise_vertical_storage_task_light_bracket	PRM		\$C\$416		1 "HML prm-4l"			
	premise_task_light	PRM			???	1 Attaches below places_canopy			
Vertically Mounted Lighting	places_counter_top_task_light	PLC			1	"HML plc-ctl"			
	places_freestanding_pivot_head_task_light	PLC			1	Requires flat surface to sit on			
	places_task_light	PLC			1	"HML plc-4l"			
	places_grid_hung_pivot_head_task_light	PLC		\$C\$416		n/a ACCESSORY 1 "Hang Stuff"	ACCESSORY		
Floor Mounted Lighting	places_panel_hung_fluorescent_light	PLC			1	"Hang Stuff"			
	places_panel_hung_pivot_head_task_light	PLC			1	"VML plc-prmfl"			
	places_panel_mounted_fluorescent_light	PLC			1	Mounts powered panels >= 18" wide, <63" tall			
	places_post_mount_steel_light	PLC			1	"Mounts on Top of Panel" AND Panel >= 63"			
Lighting Accessories	places_fluorescent_light_saddle_mount_kit	PLC		\$C\$416		1 Requires appropriate top-cap (wood or metal)	1 If nothing selected, put an x_pos = click_global x, y_pos = 0, z_pos = click_global_z, y_rot = 0		
	places_painted_shelf_task_light_bracket	PLC			1	(instantiated by premise_shelf)	???		
	places_vertical_storage_task_light_bracket	PLC			???	(instantiated by premise_shelf)	???		
	places_wood_shelf_task_light_bracket	PLC			*		*		
Organization Tackable Surfaces	premise_tackboard	PRM	N	\$A\$3		1 "Tackables"	1 "Hang Stuff"		
	places_grid_tackstrip	PLC	N	\$B\$437		Inh	Inh		
	places_tackboard	PLC	N		n/a	ACCESSORY	n/a ACCESSORY		
	premise_markerboard	PRM	N	\$B\$437		1 "Markables"	1 "Hang Stuff"		
Workflow Devices Vertical Workflows	places_markerboard	PLC	N		Inh		Inh		
	premise_all_purpose_book	PRM		\$B\$437					
	premise_lateral_file_drawer_compressor	PRM		\$C\$445		n/a ACCESSORY	n/a ACCESSORY		
	premise_lateral_file_drawer_divider	PRM			n/a	ACCESSORY	n/a ACCESSORY		
	premise_lateral_file_from_to_back_hanging_bar	PRM			n/a	ACCESSORY	n/a ACCESSORY		
	premise_lateral_file_side_to_side_hanging_bar	PRM			n/a	ACCESSORY	n/a ACCESSORY		
	premise_pedestal_drawer_divider	PRM			n/a	ACCESSORY	n/a ACCESSORY		
	premise_shelf_divider	PRM			n/a	ACCESSORY	n/a ACCESSORY		
	paper_management_bar	PRM			n/a	ACCESSORY	n/a ACCESSORY		

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Class Structure	Component Name	Prod Line	Relationship Maps		Light Weight L# Relationships
			Inherits From	Constraint C#	
Horizontal Workflows	paper_management_freestanding_vertical_unit	PLC, PRM		n/a	ACCESSORY
	paper_management_suspended_vertical_unit	PLC, PRM		n/a	ACCESSORY
	new_views_shelf_divider	PLC		n/a	ACCESSORY
	places_all_purpose_hook	PLC		n/a	ACCESSORY
	places_fundamental_pedestal_hanging_bar	PLC		n/a	ACCESSORY
	places_fundamental_pedestal_side_to_side_divider	PLC		n/a	ACCESSORY
	places_lateral_file_front_to_back_hanging_bar	PLC		n/a	ACCESSORY
	places_organization_grid	PLC		n/a	ACCESSORY
	places_shelf_divider	PLC		n/a	ACCESSORY
	places_vertical_storage_unit_grid	PLC		n/a	ACCESSORY
	tri_mode_paper_management_bar	PLC		n/a	ACCESSORY
	tri_mode_vertical_unit	PLC		n/a	ACCESSORY
	series_950_drawer_compressor	PLC		n/a	ACCESSORY
	series_950_drawer_divider	PLC		n/a	ACCESSORY
	series_950_front_to_back_hanging_bar	PLC		n/a	ACCESSORY
	series_950_side_to_side_hanging_bar	PLC		n/a	ACCESSORY
Diagonal Workflows	premise_pedestal_pencil_tray	PRM	\$C3445	n/a	ACCESSORY
	paper_management_freestanding_horizontal_unit	PLC, PRM		n/a	ACCESSORY
	paper_management_suspended_horizontal_unit	PLC, PRM		n/a	ACCESSORY
	paper_management_trays	PLC, PRM		n/a	ACCESSORY
Workflow Bins	paper_management_under_shelf_unit	PLC		n/a	ACCESSORY
	places_freestanding_grid_mailbox	PLC		n/a	ACCESSORY
	places_fundamental_pedestal_tray	PLC		n/a	ACCESSORY
	places_grid_mailbox	PLC		n/a	ACCESSORY
Diagonal Workflows	places_grid_reference_tray	PLC		n/a	ACCESSORY
	tri_mode_divider	PLC		n/a	ACCESSORY
	tri_mode_hanger_clip	PLC		n/a	ACCESSORY
	tri_mode_horizontal_shelves	PLC		n/a	ACCESSORY
Diagonal Workflows	tri_mode_horizontal_unit	PLC		n/a	ACCESSORY
	paper_management_freestanding_diagonal_unit	PLC, PRM	\$C3445	n/a	ACCESSORY
	paper_management_suspended_diagonal_unit	PLC, PRM		n/a	ACCESSORY
	tri_mode_diagonal_unit	PLC		n/a	ACCESSORY
Workflow Bins	places_grid_diskette_bin	PLC	\$C3445	n/a	ACCESSORY
	places_grid_storage_bin	PLC		n/a	ACCESSORY

Although described with reference to a particular system, the present invention operates on any computer system and can be implemented in software, hardware or any combination thereof. When implemented fully or partially in software, the invention can reside, permanently or temporarily, on any memory or storage medium, including but not limited to a RAM, a ROM, a disk, an ASIC, a PROM and the like.

Thus, a graphical user interface for configuring office furniture is provided. One skilled in the art will appreciate that the present invention can be practiced by other than the described embodiments, which are presented for purposes of illustration and not limitation, and the present invention is limited only by the claims that follow.

What is claimed:

1. A method, for use in a user computer system including a pointing device and a visual display unit, for providing a graphical user interface to a computer program for configuring furniture, the method comprising:

displaying on a screen of the visual display unit at the user's computer system questions regarding user configuration criteria;

in response to said displaying, obtaining configuration criteria from the user and providing the user configuration criteria to the computer program;

displaying in an area on a screen of the visual display unit at the user's computer system a graphical representation of at least one typical furniture configuration satisfying the user configuration criteria, wherein a furniture configuration comprises a workstation having components;

selecting, with the pointing device, a typical furniture configuration from the at least one typical furniture configuration displayed on the screen;

modifying, using the pointing device, aspects of at least one of the components of the selected typical furniture configuration to produce a modified furniture configuration;

displaying on the visual display unit at the user's computer system a graphical representation of the modified furniture configuration;

with the pointing device, selecting a validity checking option to effect checking the validity of the modified furniture configuration; and

in response to said selecting the validity checking option, checking the validity of the modified configuration.

2. A method as in claim 1 wherein the configuration criteria include at least one of:

conferencing criteria;

privacy criteria;

power criteria;

communications criteria;

storage criteria; and

area criteria.

3. A method as in claim 1 wherein the modifying of the selected typical furniture configuration comprises at least one of:

adding another component to the depiction of the selected typical furniture configuration;

deleting a depicted component from the depiction of selected typical furniture configuration;

repositioning a depicted component of the depicted selected typical furniture configuration;

changing the depicted fabric or finish of a depicted component of the depicted selected typical furniture configuration; and

changing the shape or size of a depicted component of the depicted selected typical furniture configuration.

4. A method as in claim 3 wherein the adding of another component comprises:

on the screen of the visual display unit at the user's computer system, presenting the user with various possible components which can be added; and

by the user,

selecting with the pointing device one of the various possible components; and

on the display depicting the typical furniture configuration,

positioning the selected one possible component on the depiction of the current typical furniture configuration.

5. A method as in claim 3 wherein the changing the shape or size of the depicted component comprises, with the pointing device:

selecting the depicted component; and

adjusting the shape or size of the depicted component, whereby the shape or size can only be adjusted to a valid shape or size.

6. A method as in claim 1 further comprising:

with the pointing device, selecting a price option to effect determining a price of the modified configuration; and

in response to said selecting said price option, determining a price of the modified depicted configuration.

7. A method as in claim 1 further comprising:

with the pointing device, selecting a cluster option to effect producing a cluster configuration of the modified typical furniture configuration; and

in response to said selecting said cluster option, producing a cluster configuration of the modified typical furniture configuration; and

displaying on the screen of the visual display unit at the user's computer system a depiction of the cluster configuration.

8. A method as in claim 7 further comprising:

with the pointing device, selecting a price option to effect determining a price of the cluster configuration; and

in response to said selecting said price option, determining the price of the cluster configuration.

9. A method as in claim 7 wherein the producing of a cluster comprises:

determining if the cluster configuration is a valid configuration; and

optimizing the cluster configuration.

10. A method as in claim 1 wherein the checking the validity of the modified configuration comprises optimizing the modified configuration.

11. A method as in claims 9 or 10 wherein the optimizing of a configuration comprises at least one of:

removing redundant components from the configuration;

merging components in the configuration; and

splitting components in the configuration.

12. A method as in claim 1 wherein the modifying aspects of the selected typical furniture configuration comprises modifying the entire product line of the configuration.

13. A method of configuring furniture comprising, by computer:

obtaining configuration criteria from a user;

presenting the user with at least one typical furniture configuration satisfying the criteria;

selecting a typical furniture configuration from the at least one typical configuration, wherein a furniture configuration comprises a workstation having components;

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modifying aspects of at least one of the components of the selected typical furniture configuration to produce a modified furniture configuration;

producing a cluster configuration of the modified typical furniture configuration;

checking the validity of the cluster configuration; and

determining a price of the cluster configuration.

14. A method of configuring furniture comprising, by computer:

obtaining configuration criteria from a user;

presenting the user with at least one typical furniture configuration satisfying the criteria;

selecting a typical furniture configuration from the at least one typical configuration, wherein a furniture comprises a workstation having components;

modifying aspects of at least one of the components of the selected typical furniture configuration to produce a modified configuration; and

checking the validity of the modified configuration.

15. A method as in claim 14 wherein the configuration criteria include at least one of:

conferencing criteria;

privacy criteria;

power criteria;

communications criteria;

storage criteria; and

area criteria.

16. A method as in claim 14 wherein the modifying of the selected typical comprises at least one of:

adding another component to the selected typical furniture configuration;

deleting a component from the selected typical furniture configuration;

repositioning a component of the selected typical furniture configuration;

changing the fabric or finish of a component of the selected typical furniture configuration; and

changing the shape or size of a component of the selected typical furniture configuration.

17. A method as in claim 16 wherein the adding of another component comprises:

presenting the user with possible components which can be added; and

by the user,

selecting one of the possible components; and

positioning the selected one possible component on the current typical furniture configuration.

18. A method as in claim 16 wherein the changing the shape or size of the component comprises:

selecting the component; and

adjusting the shape or size of the component, whereby the shape or size can only be adjusted to a valid shape or size.

19. A method as in claim 14 further comprising:

determining a price of the modified furniture configuration.

20. A method as in claim 14 further comprising:

producing a cluster configuration of the modified typical furniture configuration.

21. A method as in claim 20 further comprising:

determining a price of the cluster configuration.

22. A method as in claim 20 wherein the producing of a cluster comprises:

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determining if the cluster configuration is a valid configuration;

optimizing the cluster configuration.

23. A method as in claim 14 wherein the checking the validity of the modified furniture configuration comprises optimizing the modified furniture configuration.

24. A method as in any one of claims 22 and 23 wherein the optimizing of a configuration comprises at least one of: removing redundant components from the configuration; merging components in the configuration; and splitting components in the configuration.

25. A method as in claim 14 wherein the modifying aspects of the selected typical comprises modifying the entire product line of the configuration.

26. Computer-readable media tangibly embodying an interface program of instructions executable by the machine to provide a graphical user interface to a computer program for configuring furniture, the interface program comprising code to effect:

displaying on a screen of a visual display unit at a user's computer system questions regarding user configuration criteria;

in response to said displaying, obtaining configuration criteria from the user;

displaying in an area on a screen of the visual display unit at the user's computer system a graphical representation of at least one typical furniture configuration satisfying the criteria, wherein a furniture configuration comprises a workstation having components;

selecting, with input from the pointing device, a typical furniture configuration from the at least one typical furniture configurations displayed on the screen;

modifying, using input from the pointing device, aspects of at least one of the components of the selected typical furniture configuration to produce a modified furniture configuration;

displaying on the visual display unit at the user's computer system a graphical representation of the modified furniture configuration;

with input from the pointing device, selecting a validity checking option to effect checking the validity of the modified furniture configuration; and

in response to said selecting the validity checking option, checking the validity of the modified furniture configuration.

27. Media as in claim 26 wherein the configuration criteria include at least one of:

conferencing criteria;

privacy criteria;

power criteria;

communications criteria;

storage criteria; and

area criteria.

28. Media as in claim 26 wherein the modifying of the selected typical comprises at least one of:

adding another component to the depiction of the selected typical furniture configuration;

deleting a depicted component from the depiction of selected typical furniture configuration;

repositioning a depicted component of the depicted selected typical furniture configuration;

changing the depicted fabric or finish of a depicted component of the depicted selected typical furniture configuration; and

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changing the shape or size of a depicted component of the depicted selected typical furniture configuration.

29. Media as in claim 28 wherein the adding of another component comprises:

on the screen of the visual display unit at the user's computer system, presenting the user with various possible components which can be added; and  
by the user,  
selecting with the pointing device one of the various possible components; and  
on the display depicting the typical furniture configuration,  
positioning the selected one possible component on the depiction of the current typical furniture configuration.

30. Media as in claim 28 wherein the changing the shape or size of the depicted component comprises, with input from the pointing device:

selecting the depicted component; and  
adjusting the shape or size of the depicted component, whereby the shape or size can only be adjusted to a valid shape or size.

31. Media as in claim 26 the program further comprising code to effect:

with input from the pointing device, selecting a price option to effect determining a price of the modified configuration; and  
in response to said selecting said price option, determining a price of the modified depicted configuration.

32. Media as in claim 26 the program further comprising code to effect:

with input from the pointing device, selecting a cluster option to effect producing a cluster configuration of the modified typical furniture configuration;  
in response to said selecting said cluster option, producing a cluster configuration of the modified typical furniture configuration; and  
displaying on the screen of the visual display unit at the user's computer system a depiction of the cluster configuration.

33. Media as in claim 32, the program further comprising code to effect:

with input from the pointing device, selecting a price option to effect determining a price of the modified configuration; and  
in response to said selecting said price option, determining the price of the cluster configuration.

34. Media as in claim 32 wherein the producing of a cluster comprises:

determining if the cluster configuration is a valid furniture configuration; and  
optimizing the cluster configuration.

35. Media as in claim 26 wherein the checking the validity of the modified configuration comprises  
optimizing the modified configuration.

36. Media as in claim 35 wherein the optimizing of a configuration comprises at least one of:

removing redundant components from the configuration;  
merging components in the configuration; and  
splitting components in the configuration.

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37. Media as in claim 34 wherein the optimizing of a configuration comprises at least one of:

removing redundant components from the configuration;  
merging components in the configuration; and  
splitting components in the configuration.

38. Media as in claim 26 wherein the modifying aspects of the selected typical comprises modifying the entire product line of the configuration.

39. Computer-readable media as in any one of claims 26 to 38 wherein said media comprise at least one of a RAM, a ROM, a disk, an ASIC and a PROM.

40. A computer-assisted furniture configuration system comprising:

(A) a visual display unit;  
(B) a pointing device; and  
(C) interface means for providing a graphical user interface to said configuration system, the interface means comprising means to effect:

displaying on a screen of the visual display unit at the user's computer system questions regarding user configuration criteria;

in response to said displaying, obtaining configuration criteria from the user and providing the user configuration criteria to the computer program;

displaying in an area on a screen of the visual display unit at the user's computer system a graphical representation of at least one typical furniture configuration satisfying the user configuration criteria, wherein a furniture configuration comprises a workstation having components;

selecting, with the pointing device, a typical furniture configuration from the at least one typical furniture configurations displayed on the screen;

modifying, using the pointing device, aspects of at least one of the components of the selected typical furniture configuration to produce a modified furniture configuration;

displaying on the visual display unit at the user's computer system a graphical representation of the modified furniture configuration;

with the pointing device, selecting a validity checking option to effect checking the validity of the modified furniture configuration; and

in response to said selecting the validity checking option, checking the validity of the modified configuration.

41. A computer-assisted furniture configuration system as in claim 40 wherein the interface means further comprises means to effect:

(a) with the pointing device, selecting a cluster option to effect producing a cluster configuration of the modified typical furniture configuration;

(b) in response to said selecting said cluster option, producing a cluster configuration of the modified typical furniture configuration; and

(c) displaying on the screen of the visual display unit at the user's workstation a depiction of the cluster configuration.

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